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GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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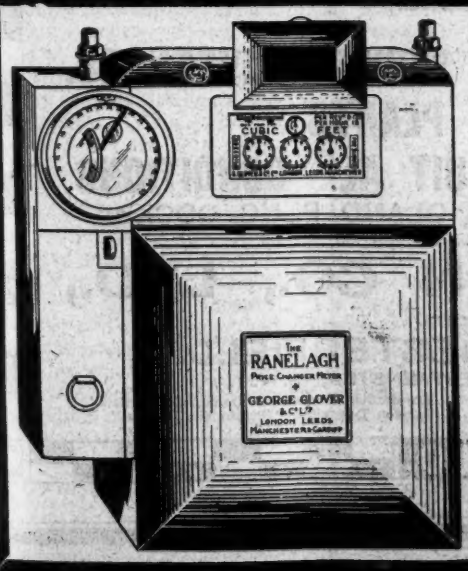

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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

VOL. CLIV., No. 3025.] WEDNESDAY, MAY 4, 1921. [73RD YEAR.

EDITORIAL NOTES.

The Deadlock.

NOTWITHSTANDING the deadlock in the wage negotiations with a view to ending the coal strike, we are not disposed to look upon the time spent last week as having been altogether wasted. It has glaringly shown two things to the country and the rank-and-file of the miners: The first is that, throughout the week, in discussing and obtaining the best possible terms for wages during the transitional period, the dominant section of the Executive of the Miners' Federation were simply fooling with the position; and the second is that the rejection of the generous terms of the Government on the ground that they do not provide for a national pool, proves that the predominant factor in the situation is, at headquarters, a purely political one. For the Labour members in the House of Commons to cry "Nonsense" when the plain fact is put forward, shows them to be entirely out of harmony with public judgment, which judgment has at any rate a wide and deep basis, and is characterized by disinterestedness, other than the interest which comes from being the hard-hit consumers of the produce of the miners' labour. We cannot understand the parliamentary representatives of the workless thousands in other industries supporting the institution of a fundamental condition in respect of the miners that cannot apply to any other industry with which they are more intimately concerned. They are simply sacrificing independence in order to obtain preferential consideration for the wire-pullers in the coal industry who have had no consideration for the interests of the rest of the community.

Early in the week, the coalowners put forward certain new proposals for a durable scheme and a temporary arrangement for a transitional period of three months. For the former, the wages in the industry would have depended upon the financial ability to pay, and for the purposes of the scheme the coalfields were to be divided into six agreed areas. Standard wages (to be a first charge on the industry), it was suggested, should be fixed as against standard profits for the owners, with the surplus revenue in each area to be divided between owners and men. For the transitional period, it was proposed that reductions in wages in each area should be of uniform amounts per shift for all workers, and should not in any area exceed such an amount as might be fixed by the Government, owners, and men for each of the three months. This led to the proposals of the Government, which in final form were: The liberal subsidy of £10,000,000 with which to supplement the resources of the industry (not for three, but for four months). It will be remembered that the Miners' Federation had offered 2s. per shift reduction. What the Government proposed was a maximum reduction of 3s. per shift for this month; and 3s. 6d. for June. For July two-thirds of the available balance of the subsidy were to be used for increasing the wages in the poorer districts; and in August the remainder of the subsidy was to be similarly applied. This plan—the last the Government had to offer—was rejected, as already said, on the ground that it did not include a national pool—a political move about which there is evidence daily that a big proportion of the men most concerned do not care a single jot. Hence the deadlock; and the scattering of the owners and miners' representatives from the centre of conference to their various districts and homes. If reliable, the intelligence from many coal centres is that the moderates among the miners are highly disappointed; and it may be it will be from the rank-and-file that there will come—perhaps gradually—repudiation of the decision of the Federation last week. The leaders are, we believe, aware that they stand in a critical position, with funds out or very low, and miners' families striving to exist on a miserable pittance, while better conditions are at hand by simply returning to work where mines are not flooded, and where loss (through foolish policy) to the extent of millions has not been incurred. It is thought by some authorities that if a ballot were taken a big majority of the men would be willing to return to work on the latest offer. It is believed that this is the very first occasion on which the Federation have acted in such an important and critical matter without taking a ballot; all they have had so far has been a more or less loose mandate from the local lodges. However, the problem of wages in the mining industry is still a problem; and with it production is, or should be, associated. But neither the owners nor the miners' representatives appear to be attacking it in a serious manner. The only solution the miners' representatives put forward is one in which, economically speaking, the artificial condition of a national pool has large part.

Negotiations having thus been broken-off with such decisiveness, nothing can be said as to the future. It is no use prophesying. With all the reports as to firmness, there is in the rank-and-file a large amount of discontent with the decision of the Federation in rejecting the final offer without a man-to-man consultation. Nearly five weeks have passed now with the pits unyielding; and on the best figures for December, this means a loss of about 25 million tons of distributable coal, or about 20 millions on the February figures. The loss to the country, to industries, to the workers in those industries, and to the National Exchequer represent millions of pounds per week. The deficit on the coal sold in March on account of the high expense of the low production per man was £5,259,209; or an average of 6s. 10d. per ton. Many gas undertakings are beginning to see danger ahead, if there is not a fairly speedy resumption of work at the pits. Even if an immediate settlement were effected, a week or two would elapse before supplies would begin to come forward, and then only in driblets. Last week we heard of small works that could not continue gas making many days unless relief were forthcoming; and others were heard of that were buying-up anything offered at high prices—as much as £5 per ton having been paid. The Government will not purchase imported coal for public utility concerns, and so gas undertakings will have to make their own arrangements, either individually or collectively, if they can secure any coal from abroad. Fortunately, the National Union of Railwaymen have announced that their ban on the transport of coal does not apply to that required for hospitals, public utility concerns, or household use, but only to that intended for commercial purposes.

However, the position has caused severe cuts to be made in all uses of fuel. Travelling facilities have been further curtailed; and more appeals have been made to the public to lessen their gas and electricity consumption. There is some talk, if the outlook does not improve, of extending by an hour "daylight saving;" and another suggestion is that a "curfew" system should be applied to lighting and heating, other than for essential industries. While the utmost economy is necessary, we hope the situation will not call for such a drastic step as this.

Calorific Declarations and Value Supplied.

The Board of Trade are pressing forward with great industry with the issue of Orders under the Gas Regulation Act, despite the many difficulties of having to investigate individually the position of the applicant undertakings. Travelling about among gas men, we have yet to hear anything but good words regarding the care exercised and the fairness of the decisions in respect of the applications. While gas men assert that the prices per therm for which request was made in their own particular cases had full justification behind them, still they are not discontented with the verdict; and they know that if experience shows that the providers of capital do not get under that verdict all the Gas Regulation Act intended they should have, they will be able to go again before the Board, and show cause for the necessary revision. The measure was framed with the view of acting, and the Board desire to act, justly.

Meantime, with the incoming of the heat-unit basis, incidental points are cropping-up. An interesting one is as to how near one will be able to work to the declared value —that is to say, what margin will be necessary to ensure the heat units per cubic foot according to declaration reaching the extremities of the supply area. It is known that calorific value does not suffer depreciation by travel to the same extent as the illuminating power of gas *per se*. But it will be impossible to fix upon any general margin of safety, because of variations in conditions. The required margin will differ according to the distance to be traversed, the conditions of the mains themselves in respect of size and friction, the calorific value declared, compression, and so forth. The lower calorific values per cubic foot are not likely to suffer quite the same percentage depreciation as the higher calorific values of the gases richer in hydrocarbons. Some undertakings will consequently require larger margins than others. At the outset, it will be necessary to have margins rather higher than will be the case when plants have been "tuned-up," and working conditions have settled down to a normal state. There will be a large amount of experimental work to ascertain how close to the declared figure one will be able to work to comply with obligations at the extremes of the area, in order to reduce the difference between therms made and therms sold, which difference, if not accounted for, will go to swell the unaccounted-for item. A difficulty that is foreseen, in connection with the difference in therms made and sold, will be to get to an annual average of the calorific value made other than by a general estimate, particularly in the case of large works with different stations and processes.

Regarding gas compression, at the Eastern Counties Association meeting, the President, in the discussion on Mr. F. A. West's paper, stated that in connection with his high-pressure distribution system, a test had shown that 20 miles away the calorific value was 6 p.ct. less than at the works. Mr. West, on the other hand, speaking in his paper of a mixture of coal gas and carburetted hydrogen gas, stated that analyses of the mixed gas before and after compression to 50 and 100 lbs. per square inch were practically the same in each case. At the moment he is inclined to think the mixed gas will stand as much compression as most others. With regard to high-pressure work, the question may be put, Is a cubic foot of gas at the initial pressure quite the same thing in respect of calorific value as a cubic foot of gas at a somewhat reduced pressure a few miles away? On the general subject, it will not be overlooked that, in respect of forfeitures, the Gas Regulation Act allows a margin of 5 p.ct. from the declared calorific value.

The Inquiries Drawing to a Close.

A large volume of evidence has now been placed before both the Inerts and the Carbon Monoxide Committees. At the moment, it is not known whether or not the last-named Committee will be hearing further witnesses; and there seems to be a tailing-off of the evidence before the Inerts Committee. Indeed, we fail to see what, if anything, can be said to supplement usefully what has already been put before them. Sir Dugald Clerk was the only witness last Wednesday; and the Committee will not meet again until to-day week. Sir Dugald is an old student of calorific power, thermal efficiency, flame temperature, and the effects of inerts. And he has had experience of the worst possible conditions—those provided by producer gas, by which an uncalculated horse power is provided to-day, and which gas can also be applied to regenerative furnaces. There are uses between these extremes for which producer gas is not suitable; and Sir Dugald does not advocate that it should become the gas for general supply. But he does want to see the liberty conferred by the Gas Regulation Act maintained, so that gas manufacture may develop on the lines that will enable the gas industry, by its subterranean means of distribution, to cater for any and every purpose for which gas is required, and that by the cheapest therm. To do so, it may be that efficiency in one or other of the uses may suffer a little; but all the evidence advanced by witness after witness, particularly by Prof. Cobb, shows that it would be very little. The gas of most universal and economic usefulness in any given area is what is required, and not a gas that serves one purpose better than the others.

Speaking generally, Sir Dugald does not think that it would interfere with the development of the gas industry if a limit of 30 p.ct. of inerts were imposed; but he cannot see any ground for imposing a limit at all. He speaks as a disinterested student of and expert on the whole subject—"disinterested" seeing that his more material interest is confined to gas suitable for gas-engines, for which producer gas is quite good. An excellent case has been made out for the considerable liberty for the gas industry which Sir Dugald and many other witnesses have claimed. To conserve coal is a national benefit. The gas industry is out for this; and nothing should be done to obstruct its endeavours to that end. To promote more healthful atmospheric conditions is an object to which there should be no hindrance. The gas industry is out for that. To promote the saving of labour and to increase both domestic and industrial efficiency are purposes which should not have any discouragement placed upon them. The gas industry is out to serve these objects better than ever. Its investigations are being pushed forward, and new practices are bringing fresh and enlightening experience. The Committee are asked by those who would place restrictions upon the industry to recommend that their limiting policy should be adopted in spite of investigation and experience, and before invention and trials have told their full story and given guidance. The Committee are asked, in making their recommendations, to accept theory and postulation, and not the disclosures of investigation and practice. The Committee, in short, are desired to do something that is positively irrational. The case for doing this has not been, because it cannot be, made out. And certain it is that, as soon as the industry gets on to a normal basis, no gas undertaking is going to do anything in the conduct of its business that will be tantamount to suicide. In that fact alone the consumers have full protection.

Presidential Suggestions and Criticisms.

The President of the Eastern Counties Gas Association (Mr. A. W. Sumner, of Grays) is known among his professional compeers for his independence of thought and practices. His address to the Association last Wednesday had that characteristic well intermingled in the composition. There were vision and suggestion. What he believes should be done, he does not hesitate to submit for consideration. At the same time he is anything but dogmatic. He leaves what he has to say to the judgment of others; and, should the verdict go against him, he will not be in any way affronted. That is the spirit—the spirit that befits these times, when every well-wisher of the gas industry desires for it the very best opportunities and the very best practices. So we feel secure in saying right-away that there are suggestions in the address with which, at any rate at the moment, we are not altogether in agreement, while fully in sympathy with the spirit that animated them.

This is a period of transition and constructive work for the industry; and we are with the President in the belief that its future lies largely in the hands of gas engineers and managers of the present day. There is no doubt of it; and there is great inclination on our part to think that there will be an excellent showing of justification for the confidence reposed in them. But are they really fitted and qualified for the purpose—speaking of them as a body? We should not like on the lead of the address alone to supply an answer negatively or affirmatively, because of certain things the President says. He deplores the fact that there are no definite lines of training for the gas profession. "The would-be gas engineer is left to fight his own way "through." Such methods of training, we read, lead to confusion, if not to chaos, and are no doubt the cause of the

diversity of opinion held on nearly every subject connected with the manufacture and distribution of gas. There is no doubt as to Mr. Sumner's views on this subject, because to him "it is not therefore surprising that, owing to the lack "of disciplined thought, gas engineers should differ so "widely in their methods regarding the production and "sale of gas." To this we find added that "it is un-"doubtedly to the disadvantage of everyone concerned that "such vital questions as the quality and nature of the re-"sultant products are not more generally agreed upon." Our knowledge of the men and affairs of the gas industry does not permit us to take the same view as the President. It is rather something to be thankful for, at all events in respect of gas, that, under the varying local conditions—raw materials, plant, and applications of the product—there is not agreement regarding the question of quality. And widely differing practices provide the safest way to finding the best for utilization under varied conditions, and are the surest means of breaking new ground in knowledge. There is danger in too great standardizing and stereotyping. The gas industry has had wide experience of the results of getting into a rut; and there is more blame to be attached to that for the decades of low efficiency—"low" relative to the accomplishments of to-day – than there will be in future with all the present activity that is permeating the industry and its men.

Upon another point which follows, the views of the President as to the lack of a definite scheme of training for professional men has some bearing. We see that he still longs for headquarters for the gas industry which shall be a true expression of its influence and capacity in the country's system and work. There are things which are often longed for, but which are not opportune. The new headquarters in Grosvenor Gardens apparently fall very far short of what Mr. Sumner has in mind. He has a vision of something much more extensive. This is patent from the enlargement of the scheme of co-operative work that he would like to see. In the suitable headquarters' building that he pictures, he would have sufficient accommodation to house a staff of thoroughly qualified technical men, with organization and facilities to meet the needs of the gas industry in all its bearings. It is an ambitious idea. The organization, he tells us, should be such that it would be the centre of reference for the gas industry on all subjects—from the purchase of coal to the latest methods of carbonization and distribution, including all the "side-issues" of general gas-works practice. This indicates how thorough he intends should become this technical side of the headquarters. We do not think that the gas profession generally would endorse the scheme. Any organization of the kind should limit itself to research and report—the same as the Institution of Gas Engineers are now doing in connection with the Gas Investigation Committee, and its valuable alliance with the University of Leeds. Would such a means of reference to the central technical staff assist the gas industry any better than a thoroughly qualified technical official at the head of each undertaking? And would it be the means of reducing the qualification and position of the gas profession? The President started off by deploring the absence of a definite scheme of training for the gas industry's responsible men. Training assists men to knowledge, and knowledge promotes individuality. There would be less need for professional knowledge if all the technical information required could be obtained from a central source. Some boards and some committees would quickly arrive at the opinion that a non-technical manager at a lower salary would suffice for them, if they could get all the technical guidance they needed from the central headquarters—particularly if they shared in the cost, which, as Mr. Sumner says, would have to be borne by the industry as a whole. However, he leaves others to judge whether or not his suggestion is practicable or desirable.

Again, we find the admission that the Gas Regulation Act is a step in the right direction; but, in the opinion of the President, it would have been better if financial relief and the heat-unit basis of supply had been kept separate. We are not so sure about that. The Act has given freedom from the legislation that restricted the opportunities of the industry; and the power given to each undertaking to declare a standard comparable with its economic conditions is something that has considerable value to the whole industry, and to future invention. There was wisdom in securing this while it was offered. It is doubtful whether the industry would ever have obtained it if the conception had been that of the industry and not that of the Board of Fuel Research. And financial revision has been facilitated by the two things being united. The reason the President is of opinion that the two changes should have been dissociated is because he feels that the industry is not prepared for the new unit. He inclines to the view that there is support for his opinion in the trend of the declarations of calorific value so far. In his judgment, there is too much of the follow-my-leader order of things found in the standards selected up to the present. Much of this criticism falls to the ground when it is remembered that what is being done is purely inceptive in the existing circumstances, and that there are provided the ways and means of revision as progress in knowledge and requirement is made, and fresh practice is definite realization. If there had been a waiting for anything approaching unanimity of opinion as to a qualitative standard (which is exactly what the Act does not provide for, and which is not required by gas undertakings generally), the industry might never have been in its present position of having a new outlook and opportunity. At the same time, it is clear that the President's objectives are the conservation of coal and the production of the maximum B.Th.U. per ton—even though the gas be down to 400 B.Th.U. per cubic foot. In this connection, he would like to see developed a plant which could provide a gas of higher calorific power than, but which can be operated with the same facility as, a blue water gas plant. Something akin to what he wants is already on the market in the shape of complete gasification plant, a sample of which is to form a unit of the producing capacity at Grays.

In the latter part of the address, there are matters of both technical and commercial interest. The desire has been frequently expressed for more information as to the cost of renewals and maintenance of vertical retorts. Mr. Sumner has an installation of Glover-West continuous verticals, which he was fortunate in securing in 1913-14. The installation has consequently had to suffer all the strain and stress of wartime conditions. The figures he gives as to repairs and maintenance are therefore highly instructive, if exception be made of an early breakdown due to causes that it would not be fair to include as now ordinary or normal. The figures may be left for investigation by readers. There is also something worth thinking over in Mr. Sumner's views of the superiority over showrooms of trained men who can advise the consumers and keep their appliances regulated. We do not by any means despise or disparage a well-appointed showroom which can be used for demonstration purposes. But we have a strong belief in the potency of well-contented consumers as advertising mediums for a gas undertaking. Experience by disinterested persons goes a long way in recommendation. The remarks on gas-meters and the production of gas appliances and burners (with which the address concludes) are the outcome of practical experience, and should be read and marked by those chiefly concerned.

Speaking generally of the address, there are characteristics about it which we like. It is not one that recounts approved experience; but it gives us thoughts which (if not acceptable in every respect) are palpably the honest product of individual consideration. The more individual thinking we have in these days, the better for the whole gas industry.

Meeting Gas Demand in Medium-Sized Works.

THE engineers of medium-sized gas-works have been as hard-hit as anyone, in respect of the difficulties arising from the war and the subsequent conditions. Many of them came out of the war with their works in a condition that needed extensive repair and renewal; but they, like all others, were confronted with dear capital and expensive materials and labour. But this was not all. By many of the medium-sized undertakings, there have been experienced heavy increases of consumption. Take the Grays Gas Company, for example, which in a decade has had an increase of 192 p.ct. in consumption, and Newark with its increase of 60 p.ct. in the past three years. These percentage figures would probably not be quite so large if the relative consumptions were translated from cubic feet to therms. But they are representative facts and conditions; and there has had to be sharp movement on the part of the responsible engineers in order to cope with the demand, and this on the most economical lines in respect of capital and labour. We cannot read the paper that Mr. F. A. West, of

Newark, submitted to the Eastern Counties Gas Managers' Association, together with the discussion, as well as the description of the extensions of plant at Grays, without reflecting on what might have been had the conditions been favourable to making plant changes on the orthodox lines. The problem has been how to meet the fast growth of consumption in the most economical way; and circumstances have forced the engineers to take a course which they might not have pursued had conditions been of normal order. What is the result?

The answer is that experiences are accruing fast that might not have been otherwise obtained, and that, as a consequence, in many works the balance of coal gas and of water gas or carburetted hydrogen gas is altering at a rapid rate—solely because of the accumulation of adverse conditions, supplemented by the rapid public desire for more gas. A proportion of 40 to 60 p.ct. of water gas or carburetted hydrogen gas is becoming, or rather has become, quite common procedure in these times, and so is the supply of a gas that varies between 400 and 450 B.Th.U. Some people say this is wrong; but with the higher pressures worked and the adjustment of gas appliances, both Grays and Newark bear testimony to the fact that the consumers are satisfied. The Tully plant particularly had quite a good innings at the meeting, owing to this being the central feature of Mr. West's paper. It told of an experience with two 300,000 c.ft. sets, which experience has issued in the installation of another plant of 500,000 c.ft. The paper gives a considerable amount of information—in fact, it takes us deeper into chemical and general working aspects (including costs) than any previous contribution to the subject. There will, for instance, be particular interest experienced in the excellent record made, under the system of working and purification at Newark Gas-Works, in regard to the lowness of impurities and the removal of such destructive agents as hydrocyanic acid and sulphur dioxide. There are hints as to the proper lines for the working of the plant, including an ingenious clock device for controlling the blows and runs. Much of what was said at the meeting applies to water gas, considerations affecting the utility of which for medium-sized works were well put by Mr. T. F. Canning in the course of the discussion. These considerations bear upon capital, storage, &c. Then, again, when one can with the supply of mixed gas—in the proportions of approximately half and half—obtain practically a straight line on a recording calorimeter chart on the district, there is, taking into account the advantages set forth, better hope of being able to weather the conditions of the present (other than those of the strike) by the medium-sized undertakings, upon which large consumption accretions have come.

The paper by Mr. West and the discussion—in fact, the whole proceedings at Grays on Wednesday—were fruitful of guidance from actual experience. At the same time, there is plenty of work in the field for new and renewal coal-carbonizing plants. It is quite obvious that the limits of requirement for these will be greatly enlarged by the expansion of the industry, and not reduced by the changes that are rapidly taking place in supplying coal and water gas or carburetted hydrogen gas in approximately equal proportions.

Fuel Support for the Competitor.

The gas industry renders very liberal support to undertakings that compete with its own primary product; but it gets very little thanks. For three or four decades now it has been helping to maintain, through the rates, those local authority electricity undertakings that suffer financial prostration. And now in the time of stress many of them are drawing upon gas-works for fuel supplies in the form of coke. There is no objection to this. The industry has been cultivating business relations with electricity generating stations in regard to the use of coke for a long time past, and quite a respectable business is being done in this direction, mainly through the Nicol "Sandwich" system. We hope that the assistance in the hour of need will result in more permanent relations in this respect. Gas-works, as a rule, have larger coal-storage capacity than electricity undertakings; hence the ability to help with coke. But it cuts against the grain a bit to see coal going out of gas-works to electricity stations. Probably the boilers at the Oswaldtwistle electricity station cannot use coke; and this may be the explanation of the transfer of 50 tons of coal, instead of coke, from the gas-works stock to the station. The reason adduced for the transfer is that, as the gas-works are dependent upon the station for current for driving plant, it is to the interest of the gas-works to help to keep the supply of energy going. There is usually a preference for gas-works to generate their own electrical energy, and thus show manufacturers how well and cheaply they can do it with small plants *in situ*.

Gas Coke and Slack.

It is reported that in some districts up North a mixture of gas coke and slack is being rationed for domestic use; but the amount of this material is totally inadequate to meet the demands. Even from adversity lessons are derived.

Coke-Oven Gas for Town Use.

Of course, it does not pay the proprietors of bye-product coke-ovens to run their plants solely to fulfil their contracts with undertakings that buy gas from them. They cannot afford to continue piling-up stocks of metallurgical coke, which would depreciate in the extra handling and the keeping, when there is not the demand for it; and when they cannot get coal, they can neither make coke, gas, or anything else that results from their carbonization process. A great slump came in the metallurgical coke market before the coal strike occurred; and now those towns that were drawing large supplies of gas from coke-ovens find this source of contribution in some cases almost wholly cut-off, and in other cases completely so. Simultaneously, the gas-works coal stocks are dwindling. But the cessation of the gas contribution of the coke-ovens has meant the heating-up of old and less efficient carbonizing plants, and bringing more water-gas plant into operation. Fortunately, coal strikes do not come every day; but although the gas industry has the greatest respect for the dogma of coal conservation, and utilizing to the best advantage all available serviceable gas, it will have to make a very considerable discount from the value of coke-oven gas, if it has to keep sufficient plant available to compensate for the temporary loss of such an important tributary to supply. Labour is becoming more and more the critical factor as an interrupter of supply; and metallurgical market conditions will at intervals have the effect of reducing maximum gas-supply capacity to a much lower level, and this may come at the times of heaviest gas demand. These conditions cannot be ignored in the developments (which are very proper) of business relations with the coking industry.

A Man's Work.

The members of the London and Southern Junior Gas Association last Friday had before them a gas engineer who has made, and unobtrusively, big strides in the gas profession—Mr. John Terrace, the Chief Engineer of the South Suburban Gas Company. He did not put himself forward as a model; but he is well qualified to speak to juniors on "A Man's Work," and he did it well. A man's work! Where does it begin, and where does it end? It begins immediately in life when one can discriminate between right and wrong; and it does not end until the final call. What is a man's work? Mr. Terrace went into it at a length to which we cannot go in these times. But what he said so fully and well supplies the epitomizing answer, To do justice to himself. If he does that in every respect, he cannot help acting justly to the work to which he puts his hand, and to all persons with whom he comes in contact. Towards the end of the paper, there was further interest in the particulars that Mr. Terrace gave of ready means of keeping and obtaining information on various matters by means of recording systems, models, and indicators of various kinds, such as are used in the offices of the South Suburban and Tottenham Companies.

Local Rates Bill.

The Local Rates (Increase Prevention) Bill, which was noticed in our editorial columns last week, had second reading in the House of Commons last Friday, but not without the sacrifice of clause 2. The Government were opposed to this clause, and would have resisted the second reading had the promoters not withdrawn it. It is the one that sought to transfer from the Ministry of Health to the Treasury the powers the former now possess with regard to loans and the property of local bodies. A curious feature of the discussion was that the Labour Party appeared to be unanimously antagonistic to a measure that seeks to place greater control over local expenditure, to the insufficiency of which control hitherto the height of the rates to-day testifies.

EMERGENCY REGULATIONS, 1921.

A FURTHER direction under the Emergency Regulations, 1921, was issued last week by Mr. Bridgeman (the Secretary for Mines), dealing with the restriction of street and other public lighting.

The Coal Emergency Directions issued at the beginning of the strike required local authorities to restrict such lighting as much as possible; but as this did not lead to the curtailment that was considered necessary, the new direction requires that, subject to police needs, the consumption of gas and electricity for street and other public lighting shall not exceed 50 p.ct. of the quantity supplied and consumed on the corresponding date of last year.

PERSONAL.

The Bolton Corporation Gas Department recently advertised in order to fill a vacancy caused by the retirement of Mr. HARDIKER, who was junior to Mr. J. BRIDGE on the staff of Mr. W. J. Smith, B.Sc. (the Engineer and Manager). Mr. Bridge has now sent in his resignation, on his being appointed to succeed the late Mr. Robert Porter as Engineer and General Manager of the Elland-cum-Greetland Gas Company. This makes two vacancies to be filled; and the Bolton Gas Committee have decided to leave the junior post in abeyance until such time as they have filled the senior position.

Mr. E. D. WOOTTEN, who has for some years been Gas and Electricity Engineer and Manager at Abertillery, has been appointed to a similar position with the Malvern Urban District Council. The system of separate control has now to be reverted to. Mr. IVOR G. JENKINS, the Assistant Manager, has been appointed to succeed Mr. Wootten as Gas Engineer and Manager for the ensuing six months, at the end of which time, it is understood, the question of permanent appointment will be considered.

Mr. J. B. WILLIAMSON has resigned the Chairmanship of the Tynemouth Gas Company, North Shields.

Mr. CHARLES HENRY WATKINS, Chief Exchange Clerk of the Birmingham Gas Department, has retired after 43 years' service. Alderman J. H. Lloyd, the Chairman of the Gas Committee, presenting Mr. Watkins with an address, stated that he had carried out his duties with uniform ability. It was a post which required the exercise of much tact. Mr. Watkins entered the service of the Gas Department in 1878, at the age of 20.

The Directors of the Hong Kong and China Gas Company, Ltd., report with deep regret the recent death of Mr. FREDERICK G. BARRETT, who had been Secretary since 1903. They have appointed Mr. ALBERT C. PULLEN to the vacant position.

The Annual Dinner and Concert of the London and Southern District Junior Gas Association, which was postponed owing to the threatened railway strike, has now been fixed to take place on Friday of this week, at Anderton's Hotel, Fleet Street.

Lectures on Coal at Sheffield.—Announcement is made of a course of four lectures on "Coal," to be delivered on Thursday afternoons, May 5, 12, 19, and 26, in the Mappin Hall, St. George's Square, under the auspices of the Department of Fuel Technology of the University of Sheffield. The lecturers, in the order named, will be Dr. Marie C. Stopes, on the "Constitution of Coal;" Captain F. S. Sinnatt, "Sampling of Coal;" Dr. R. Lessing, "Carbonization of Coal," and Mr. R. Wynter Blyth, "Crude Benzole." The fee is 10s. 6d. for the course.

Elements of Illuminating Engineering.—Mr. A. P. Trotter is the author of a small book (one of Pitman's Technical Primer Series) on the "Elements of Illuminating Engineering," in which is included quite a lot of matter, accompanied by illustrations and tables, on a subject the importance of which is becoming more and more widely recognized. It is written for students, junior engineers, architects, and others desirous of obtaining an insight into the theoretical principles of artificial lighting. The seven chapters into which the text is divided deal with definitions and laws, vision and glare, emission of light from a source, sources of light, reflectors and shades, photometry, and planning. The book is of pocket size, and is published, at the price of 2s. 6d. net, by Sir Isaac Pitman and Sons, Ltd., Parker Street, W.C.

Society of Chemical Industry.—On Monday evening there was a meeting at Burlington House, Piccadilly, of the London Section of the Society of Chemical Industry, at which two communications were presented. In the first, Dr. R. Lessing drew attention to the advantages of packing absorption towers and distilling columns with contact rings of the type patented by him, and consisting of cylinders of approximately equal height and diameter, with a gap in the circumference and a more or less diametrical partition connected on one side with the cylinder, but out of touch on the opposite side. They are disposed indiscriminately in the tower or column at the angles which they find when dropped promiscuously into a vessel. The provision of the central partition and openings has been found to increase the efficiency of this packing over Raschig rings. The second paper was by Mr. N. E. Rambush, and dealt with the causes of thermal losses in the gas-producing process. The points to be generally considered when estimating the anticipated thermal efficiency of the gasification of a certain fuel, the author placed under ten headings. Some fuller notice of the two papers is unavoidably held over.

ELECTRICITY SUPPLY MEMORANDA.

SOME nasty knocks are being administered just now to municipal trading in electricity, and to the enormous additional capital expenditure that is proposed not only for existing stations, but for the power stations and transmission lines which are the features of the generation reorganization schemes in the country.

Manufacturers and New Electricity Expenditure.

Not long since we saw that at Birmingham progress with the new power station scheme was stopped through inability to raise capital, and an appeal was made to the local manufacturers to subscribe the necessary capital to permit of the work of plant extension being proceeded with. But no indication has been forthcoming that the manufacturers rose to the occasion. Then last week we saw how Chambers of Commerce up North were strongly opposing the advance by local authorities of money to joint electricity bodies for the speculative purpose of providing large power stations. They see a good possibility of the expenditure increasing the weight of the burden of the rates. And they may be right. Apart from these schemes of the proposed joint authorities, all over the country municipal authorities are proposing to spend money on extensions; and applications are being forwarded every week to the Electricity Commissioners for sanctions to additional loans. Now we find that about a dozen engineering firms in Newark and the district are up in arms against a proposal of the Corporation to apply for a loan of £200,000 for carrying out an electricity scheme, which might not have cost half the sum before the war. The engineering firms in question are taking their stand entirely on financial expediency. They hold that the scheme ought to be postponed, as up to the present there is no proof that the undertaking would receive the support necessary to ensure its financial success. The firms deliberately state that, so far as they are concerned, they shall not, on the figures submitted, avail themselves of the supply. This statement appears in a letter addressed to the Town Clerk. It then frankly proceeds thus: "On the other hand, if the price of the power is reduced to induce us to take it, the loss so incurred would fall on the ratepayers; and we strongly deprecate the principle that those who avail themselves of the power supply should be subsidized at the expense of the other ratepayers. In view of the present financial stringency, and the high cost of material (which latter will presumably come down within a measurable period), we most emphatically express our opinion that it is the duty of the Council, in the interests of the ratepayers, to defer incurring any avoidable capital expenditure at the present time." We admire the candour of these engineering firms, and the public spirit in which their protest is made. These are welcome signs of a new interest in municipal affairs; and we hope to see it spread.

The First Joint Authority.

The Mersey and West Lancashire electricity district has the honour of possessing the first Joint Electricity Authority. The Electricity Commissioners have determined this; and it is to include the whole area, subject to a reservation concerning Wirral. It appears to the Commissioners that the advantages to the local authorities in the Wirral area of independent combination will for some years outweigh those of inclusion in the whole area. Subject, therefore, to liaison with the Joint Electricity Authority, a separate Committee will be established representative of the local authorities for the county boroughs of Birkenhead and Wallasey, the urban districts of Hoylake and West Kirby, and a number of smaller authorities. Although the Commissioners have arrived at this conclusion after a critical comparison of the estimates submitted by the promoters of the two schemes as subsequently amended by the Commissioners, they are of opinion that it may be found advantageous at some future date to merge the Wirral Committee in the Joint Electricity Authority. In the announcement it is stated that a capital station in the neighbourhood of Liverpool, and a transmission system connecting it with Liverpool, Bootle, Prescot, and St. Helens, is immediately required, and will be of advantage to the neighbouring districts. At the same time, the fullest and most efficient use should be made of the generating plant of the Mersey Power Company. This Company, by arrangement with the Joint Electricity Authority, and with the approval of the Commissioners, and subject to suitable conditions, may be empowered to extend their operations by bulk supply or otherwise into neighbouring districts. The Company will have separate representation upon the Joint Authority, to which it will elect one member. The areas of the Wirral Committee and the Mersey Power Company should in due course be linked-up with the remainder of the district. A draft Order embodying this decision will be issued shortly. It will also provide for the administrative expenses of the Joint Electricity Authority being met by contributions from each of the interests represented on the authority; and for any deficiency on revenue account which may arise from the supply of electricity being, by a readjustment of charges or otherwise, met only by those undertakings which are connected with the Joint Authority's transmission system. The necessary financial powers will be conferred on the Joint Electricity Authority and the Wirral Committee, subject in the former case to the enactment of the Electricity (Supply) Bill now before Parliament, the

rejection of which, by the way, several members of Parliament are proposing to move on second reading.

Housing Schemes and Electricity.

According to a report before us, the Barnsley Corporation are proposing to supply the new Corporation houses with electricity for a certain sum per week added to the rent. We are not quite sure what this means; but if it is intended that the charge for current is to be a fixed one, and hidden away in the rent, then this course is one that is to be strongly deprecated. Strict accounts ought to be kept of the amount of money paid for current, and of the quantity of current used; so that the ratepayers may know whether or not this particular part of the business of the Electricity Department is a paying one. This much is due to the ratepayers; and it is also a matter upon which the other consumers of electricity should insist, because it is not right to them that any consumers should be supplied on terms which favour them if the conditions of supply in respect of quantity are equal or inferior to those of the other consumers. In principle, if not in amount, it is almost as bad for the electricity consumers who are profitable customers to have upon the books of the undertaking unprofitable customers, as it is for the ratepayers to be called upon to meet deficits through insufficient being charged for current to meet all the financial obligations of the concern. It has frequently been seen that where fixed charges are made, the tendency is for initial economical consumption gradually to grow to extravagant consumption. It is altogether bad business; but it is worse when (if this is to be the case at Barnsley) the amount paid for current is to be concealed in the rent, and no information be given of the quantity of current consumed.

Insurance of Electrical Plant.

There have been many accidents to electrical plant during the past twelve months; and something as to this is mirrored in the statement made by the Chairman of the British Engine, Boiler, and Electrical Insurance Company Ltd. (Mr. R. C. Longridge), at the annual meeting. He intimated that during the past year there were some particularly heavy losses caused through the breakdown of large generating machines in public electricity supply stations—sometimes at the steam end, and sometimes at the electrical end; and an accident in the London area, involving a break-up of the generator (a piece of which was flung across the Thames, unfortunately killing a man), proves that generators are not immune from mechanical damage, while, of course, the risk of damage from electrical causes is material. He says there is a readier disposition on the part of public authorities to insure against such losses. This, no doubt, reflects the stringent financial situation and recognition of the fact that repairs to such machines (which to a large extent must necessarily be paid for at overtime rates) cost three to four times as much as in pre-war days.

Cultivating Rural Areas.

Our old friend Mr. Napier Prentice, Engineer and Manager of the East Anglian Electricity Supply Company, has been on a mission to Long Melford, with the view of linking-up that town with his Company, who are spreading their arms into rural areas. If electricity is to come in such towns, no better time for the gas competitors could be than now, for this is the peak-time in capital outlay for electricity extensions; and the greater the capital expenditure, the heavier the annual burden of capital charges upon the cost of current. In this instance, Mr. Napier Prentice estimates that it will cost £2000 to extend the cable from the Sudbury power house to Long Melford, and another £2000 for the distributing system in the town itself, including meters. Looking at this figure and the price of meters, apparently he does not anticipate that many meters will be required. But the people of Long Melford may take it that, if they subscribe the capital required for this extension, they will find in these days the installation expenses are rather more than many of them will care to incur. "Look before you leap" is a sound maxim in this as in any other connection. However, the subscription of capital is a matter for the Long Melford people with money to invest to settle for themselves. To get the capital was the object of the visit of Mr. Prentice. But we really wish that he had kept to facts. He asserted that, in the case of heating by coal, 90 p.ct. of the products of the coal went up the chimney, and only 10 p.ct. of the heat passed out into the room. As a matter of fact, the usual proportion of the heat value of the coal used in the domestic grate that is given-out as useful heat to a room is approximately 20 p.ct.—not 10 p.ct. Electricity cannot give in useful heat to a room such a percentage of the heat value of the coal used in electricity stations, for the simple reason that the average efficiency to-day of electricity generation is only about 7 p.ct.! Mr. Prentice's figures need drastic revision. Again, it may be a plausible way to put it for the people of Long Melford, but there is not accuracy in the final part of the following statement: "If coal was properly used and was distilled, one of the products was oil, and another was gas; and these could be used to generate power. By electricity they had the means of using that power efficiently, with the result that, with one-third the amount of the coal burned at the generating station, they could get as much electricity to do (for instance) cooking as three times the amount of coal used in the kitchen range." Perhaps Mr. Prentice only takes into account the electric oven, and not all the work that would have to be done on the hot-plate, the efficiency of which is not good, particularly when considered in relation to the poor efficiency of electricity generation. We also see that he states that the wastage of meat with ordinary cooking is 35 to 40 p.ct., whereas with electrical cooking it is 10 p.ct., and could be brought down to 5 p.ct. The householders of Long Melford must not be misled by these attractive figures. The term "wastage" is inaccurate. It is largely evaporation of water, which has no nutritive properties. The 35 to 40 p.ct. is an exaggeration. If temperatures are uniform, the duration of cooking the same, and the constitution of the joints of meat comparable, there need be no difference in loss of weight, whatever the source of heat. The heat given off by electricity has no miraculous virtue individual to itself. However, these are among the statements that Mr. Prentice put before the people of Long Melford with a view to induce them to subscribe money for the proposed extension; and, as seen, we do not agree with them.

Too Costly.

Bearing upon the preceding paragraph, we read in an electrical paper that "the proposal to use electricity instead of gas for lighting King Street, Aberdeen, has been dropped owing to the excessive cost, which is stated to be £756." In another electrical paper, it is reported that the Grangemouth Corporation have agreed that, owing to the difference in cost between installing gas and electric lighting, they have no alternative but to adopt the cheaper method of lighting—viz., gas—in the municipal houses. The Borough Engineer reported that the cost of gas lighting was £7 10s. per house, and electric lighting £12 10s.

The Doherty Washer-Cooler.

An account of the installation of additional cooling apparatus in connection with the water-gas plant of the Houston (Tex.) Gas and Fuel Company, is given by Mr. Allan E. Lockwood in the "Gas Record." Gas was made direct into the relief holder, which was of a capacity of 200,000 c.ft.; and there were unusual load conditions, caused by the large number of room-heaters used during the occasional cold spells—the send-out sometimes increasing overnight by as much as 2½ million c.ft. It was decided to instal a Doherty washer-cooler, to operate at the inlet of the exhauster. Use was made of the existing scrubber, measuring 10 ft. in diameter and 28 ft. high, which was filled with wooden trays made up of ½ in. by 6 in. boards, placed on edge about ¾ in. apart. The gas, coming from the condenser, enters at the bottom of the scrubber, and the cooling liquor at the top. The liquor, passing down through the gas, is distributed by a rotary spray consisting of a box, nearly as long as the diameter of the scrubber, about 8 in. high and 10 in. wide, made up of iron, wood, and canvas. The top is of flexible steel plate, fastened at the middle suspension point, and supporting the sides and ends. The bottom is fastened to each end and half of each side with canvas, leaving an opening for half the length on each side for the spray, so that a rotary motion results, similar to that of a lawn sprinkler. The opening, therefore, depends upon the volume of cooling liquor entering the spray, and is greatest at the ends, giving a very even distribution in the form of a helix. An extension up through the top indicates the speed of the spray, which is about 16 R.P.M. During peak-load conditions, gas enters the cooling apparatus direct from the water-gas generators. The same liquor is continuously circulated. When first operated, it was found that the temperature of the liquor at the outlet of the cooler was about 20° lower than the temperature of the gas at the inlet. The wooden trays were then altered so that the upper section was completely filled with lengths of about 8 in. by 1½ in. by 1½ in. This broke-up the cooling liquor and gas, and gave much closer contact, so that a difference in temperature of only about 7° existed.

Coke-Oven and Bye-Product Works Chemistry.—Messrs. Charles Griffin & Co., Ltd., of Exeter Street, W.C., forward a copy of "Coke-Oven and Bye-Product Works Chemistry," by Mr. T. Biddulph-Smith, F.C.S., Manager and Chief Chemist of the coke-ovens and bye-product works of Messrs. Samuel Fox and Co., Ltd., of Stocksbridge. The book, which will be noticed more fully later, is well illustrated, and contains a series of folding plates. The price is 21s.

Elland and Halifax Families United.—St. Mary's Church, Elland, was crowded last Wednesday to witness the marriage of Major G. W. I. Learoyd, the second son of Mr. and Mrs. J. Russell Learoyd, of "Marlow," Halifax, and Miss C. Vere W. Broadhead, the only daughter of Mr. J. W. Broadhead, of "The Hollies," Elland. The Rev. M. A. Maddocks (rector) performed the ceremony. The bride was given away by her father; and Mr. R. W. Broadhead, her brother, officiated as best man. The families of the parties are very well known in the Halifax and Elland districts; Mr. Broadhead holding high positions in free-masonry. He is the Managing Director of the firm of Messrs. Robert Dempster & Sons, Ltd., of Rosemount Iron-Works, Elland. After the ceremony a reception was held at "The Hollies," and later Major and Mrs. Learoyd left for a motor tour in the South of England. On their return, they will take up residence at "Laurel Cottage," Stainland.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

HALF-YEARLY MEETING AT GRAYS.

Members of this Association held their half-yearly meeting last Wednesday at Grays, Essex—the President this year being Mr. Arthur W. Sumner, the Engineer and Manager of the Grays and Tilbury Gas Company. There had been some fear in the minds of the President and the Hon. Secretary (Mr. W. H. Mainwaring, of Lincoln) that the meeting might not be so successful as it otherwise would have undoubtedly been had there not been the coal difficulty and disappearing stocks, as well as the curtailment of railway facilities. But on Wednesday morning as the trains arrived, fears vanished; and the party of members and friends ultimately numbered 62. Among the friends were seen the Hon. Secretary of the Institution of Gas Engineers (Mr. W. E. Price) and the Secretary (Mr. Walter T. Dunn). Mr. C. F. Botley (the ex-President of the Southern Association) travelled from Hastings. There was Mr. Alex. A. Johnston, who was at Ilford when Mr. Sumner was receiving there his early training in gas work under his father, the late Mr. George Sumner. There were other visitors—Mr. L. Trewby, of the North Middlesex Gas Company, and Mr. C. Chambers, of Harrow. We have mentioned that Mr. Sumner commenced his gas career at Ilford. It may be added that in 1901 he was appointed General Assistant to the Woking District Gas Company; and in 1903 he received the appointment of District Superintendent to the Mitcham and Wimbledon Gas Company, under the late Mr. Benjamin Green. In 1905, he took up a similar position with the Grays and Tilbury Gas Company; and in 1910, he succeeded Mr. Thomas Shadbolt as Engineer and Manager. The make of gas at that time was 76 million c.ft. During the past ten years, the whole of the works has been remodelled and brought up to date. The area of the district has been twice extended by Act of Parliament; and a high-pressure distribution system has been installed. It is believed to be the largest high-pressure system in Europe. The make of gas for the year ending December, 1920, was 224 million c.ft.

A VISIT TO THE WORKS.

Those visitors who reached Grays in time paid a visit to the gas-works, where Mr. Sumner had much of interest to show them; for it was very clear that the Company have a go-ahead Board, who believe with their Engineer in gaining manufacturing economy by the adoption of processes that can achieve it, and in always being on the alert for new business when there are signs that it will be remunerative.

The site of the works is some 2½ acres in extent; and at the rear run the lines of the Midland Railway Company (L.T. & S. section). A siding has been taken off the private railroad of the Grays Chalk Quarries Company; and by a working arrangement between the two Companies, the coal supply can be obtained either by rail or river—the trucks being hauled by light engines, the property of the Grays Chalk Quarries Company. For the purpose of unloading the trucks a 3-ton Grafton steam travelling crane is installed, fitted with a 10-cwt. Williams grab, and mounted on a steel-framed gantry some 78 ft. in length by 6 ft. wide, and 7 ft. high. The gib of the crane has a 32 ft. radius. The coal is stored in the open; and the space provided is capable of accommodating about 2000 tons.

The vertical retort house and plant were erected in 1914 by West's Gas Improvement Company, to replace the old horizontal retort house. It is situated close to the coal-store; and an elevator (of the gravity bucket type, fitted with a crusher in the boot) is provided for conveying the coal, either from the store or the railway trucks direct, to the overhead hoppers above the retorts. The same elevator is also used for coke required for the furnaces; a division plate and a movable slide being provided for the purpose. The retort-house contains sixteen vertical retorts; each four retorts having a separate step-grate furnace. The setting is so arranged that any two retorts can be shut-down separately if so desired. The nominal capacity of each retort is 2½ tons per day. There is one collecting main (wet); but the ascension-pipes are not sealed. The coal-bunkers are placed directly above the retorts, and are capable of holding 24 hours' supply. There is also a coke-bunker of 6 tons capacity, sufficient for 24 hours. The coke extracting gear is placed at one end of the settings.

Adjoining the retort-house is an engine-house, containing a 27-H.P. gas-engine for driving the elevator and breaker; also two 3½-H.P. engines for driving the extracting gear. More recently an additional pulley has been provided; so that during the time the elevator is in use the coke extracting is done by the same engine. The smaller engines are used alternately at all other periods of the day. The gas is controlled by a retort-house governor, and conveyed through a 12-in. steel main connected to the foul main of the horizontal retort house.

The steam supply for steaming the charge in the retorts is brought from the boilers, and passed through Ferguson's superheaters inserted in the two main chimneys, and heated by the waste gases passing from the settings.

An adaptation of Meade's reflux system has recently been installed; hot gas liquor being continually pumped through the collecting main, which is conducted to a separator, where the liquor and tar are separated hot, and conveyed to the respective storage wells.

No. 1 retort-house is of the horizontal type, and is 120 ft. long by 32 ft. wide and 19 ft. high. Adjoining is a coal-store, 120 ft. by 24 ft. by 19 ft., and capable of holding 1000 tons of coal. In the retort-house are four beds of eights and two beds of sixes (regenerative settings), and five beds of sixes (direct-fired settings). The retorts are of Ω section, 20 in. by 15 in. The approximate capacity of the house is 450,000 c.ft. Since 1914 this plant has only been used in cases of emergency.

A Tully plant of 600,000 c.ft. capacity, with dual generator, is being installed in a section of the old coal-store. In this case the fan for the air-blast is to be driven by a 32-H.P. four-cylinder gas-engine.

The condensers are of the atmospheric type, of 500,000 c.ft. capacity, fitted with 12-in. connections.

The exhauster-house contains two Bryan Donkin gas-exhausters, steam-driven and direct-coupled—one of 50,000 c.ft. capacity per hour, and the other 40,000 c.ft. per hour. Also seen is an old type "Alfred Williams" exhauster of 20,000 c.ft. capacity, which is used for the water-gas plant. There are also two "Imperial type Ingersoll Rand" gas-compressors, of 25,000 c.ft. capacity, each at 100 lbs. pressure.

As to the washers, these consist of a Cockey machine, 1,000,000 c.ft. capacity, a Holmes tower scrubber, 8 ft. diameter and 55 ft. high, and one old type Kirkham-Hulett rotary washer.

There are eight purifiers in all—the smaller set (four in number, and of the luteless type) being 20 ft. by 20 ft. by 4 ft. 6 in., and capable of dealing with 500,000 c.ft. per day. These are fitted with a 12-in. Weck valve. A newer and larger set of four boxes (also of the luteless type) are 25 ft. by 25 ft. by 6 ft., and of 1,000,000 c.ft. capacity. These are fitted with a Weck valve in the centre, and are elevated on a steel framework 7 ft. above the ground. Each box has four bottom discharge doors. Carried over the top of the boxes is a reinforced concrete floor, capable of storing 300 tons of oxide, and covered with a corrugated iron roof. An elevator, fitted with a Harrison Carter oxide crusher, is used for crushing and lifting the oxide to the top floor; and the boxes are filled by means of canvas shoots. The ordinary wooden sieve is used for the bottom layer of oxide; the top layer being held more loosely on strips of wood, 2 in. by 2 in., 4 ft. long, spaced 2 in. apart.

The connections are 15 in. diameter; and the gas enters the boxes at the top and leaves at the bottom. Backward rotation and weekly changes is the method employed.

The carburetted water-gas house contains two sets of Messrs. Humphreys and Glasgow's plants—one of 400,000 c.ft., and the other 250,000 c.ft. capacity. Lavals' steam turbines in duplicate are used for the air-blast—being situated in a room at the same level as the operating-floor. On the roof of the turbine room is supported a cast-iron water storage tank of 30,000 gallons capacity.

We will pass over the boiler and water-softening plant. But it may be noted that the whole of the gas is measured through a Venturi tube (Geo. Kent, Ltd., makers), with a capacity of 50,000 c.ft. per hour. Another point is that the coal-gas and water-gas connections are arranged so that the gas can be mixed at the inlet of the coal-gas exhauster or at the inlet of the tower scrubber, as desired. It is however proposed, at a later date, to use the small set of purifiers for the water gas only, and mix the gases at the outlet of the meter.

The relief water-gas holder is of 30,000 c.ft. capacity; and the two other holders are of 220,000 and 350,000 c.ft. capacity.

A Parkinson and Cowan governor, with 18-in. connections, is used for regulating the pressure required on the district. A large proportion of the district is supplied with high-pressure gas. The compressors are installed in the exhauster-house, and are connected to a suitable high-pressure receiver outside; the gas being broken-down by a set of Equitable high-pressure governors in duplicate, before entering the district mains.

The present site is rapidly becoming too small, and (as was seen) practically every available piece of ground has been made use of. A new site of 15 acres (about a mile distant) has been secured, on which it is proposed to erect new works, as and when required. This new site is also situated so that direct communication with river and railway can be secured.

The district supplied now comprises an area of approximately 160 square miles; there being about 100 miles of mains, supplying 44 towns and villages.

The number of consumers at the end of last year was 8528, of whom 6784 are slot consumers. The capital of the Company is £217,109 17s. 9d. The consumption last year was 234,109,000 c.ft. The total increase since 1910 has been 147,419,000 c.ft., or 192 p.ct. This is indeed rapid growth.

A LUNCHEON AND SOME SPEECHES.

After the visit to the works, there was a luncheon at the Queen's Hotel; the hosts being the Chairman and Directors of the Gas Company. The genial Chairman (Lt.-Col. F. E. Bartlett) presided; and he was supported by three of his co-Directors—Mr. John Dunstall, Mr. P. G. Gale, and Mr. Worthington Church. Unfortunately, the Deputy-Chairman (Mr. Courtenay C. S. Fooks, J.P.) and Mr. G. C. King could not be present. The Secretary of the Company (Mr. W. F. Whittaker) was there, and rendered invaluable help during the day to Mr. Sumner.

After luncheon the toast of "The King" was honoured.

The CHAIRMAN next submitted, in a happy speech, the toast of "The Eastern Counties Gas Managers' Association." He said that, in his opinion, the creation of these District Associations was one of the finest schemes ever propounded in the gas industry. They not only brought together the men of each district to compare notes and to go round each other's works, but the meetings enabled them to pick-up valuable wheezes. They had there that day representatives of gas-works covering the whole of the Eastern Counties. In their own case, Mr. Sumner was also a member of the Southern Association; the reason being that the meetings were held in London, and so were very convenient for their Manager to attend. Now he was in the honourable position of being the President of the Eastern Counties Association. He coupled with the toast the name of the President of the Association—his friend, Mr. Sumner. He said "his friend," because he was sure Mr. Sumner would admit that, during the sixteen years they had worked together, they had never been at cross pur-

poses. They had argued-out a great many points; but they had generally arranged to meet at the happy mean. The Company had made great steps forward since Mr. Sumner first came to them as District Superintendent, in which position he acquitted himself so well, and showed so much energy, that in July, 1910, the Board appointed him Engineer and Manager to the Company. They had never regretted it. They had made enormous extensions, until now the district of supply covered 160 square miles. They had bought-up the works of various small companies, laid high-pressure mains through their areas, and eventually closed-down the small works, and supplied the gas from Grays. This was a scheme that promised to be a highly paying one; and it had proved to be so, although they had only laid the actual arterial mains. The small distributing mains to various hamlets and villages they were not able to lay at the time (1914); and since the war the prices of materials and labour had been so high that it had not been a paying proposition. And, moreover, Mr. Sumner had himself been working practically at high pressure all the time. However, considering all things, he had worn very well. There was one point he should like to impress upon all present—that was the combined subscription to their representative central organizations. It was 5s. per million cubic feet. He hoped they would all advise their Boards to pay this. If the gas undertakings hung together, they were irresistible, and nothing could stop them. He believed that in a short time the industry would have passed over the worst of its difficulties; and he urged all present to be as well prepared as was possible for the increased business that would certainly come.

The President, in responding, said he was almost too "full" for words. [Laughter.] He felt he ought first of all to thank his Chairman very much for the kind words he had used regarding himself and his work, and also those present for the way in which they had accepted the toast. He thought it must be quite apparent to all present why their works at Grays had gone ahead. He was afraid it was not due so much to the energies of the Manager as to the energetic Chairman and Directors under whom it was his lot to serve. One of his difficulties in the management of the works had been to keep up-to-date. His Chairman was always anxious that he should do this. If he tried to go to sleep, it would be quite impossible. Any success he might have had in the management of the undertaking had not only been due to his own work, but to that of the Board, as well as to the fact that he had managed to get around him good assistants in every department. He was very much obliged to them for helping him in the position which he occupied, because he did feel that, if they had not good assistants, it was very difficult indeed to carry on. The past few years had been very trying ones for all gas managers, and not least to the one at Grays. The growth of the works had been very rapid; and during the difficult times they had been through, he could assure them that the position had not been easy. Regarding the Eastern Counties Association, the Chairman had touched upon the fact that it covered a very large area. He was glad indeed that his Board had always recognized the fact that it was a good thing for men in a profession like their own to keep in touch at all times; and he could assure his Chairman and Directors that the meetings had always been to him and others of great assistance. In the Eastern Counties district, the members were spread about so much that they had to vary the place of their meetings. They selected their Presidents with this in view, so as to give the members a chance of getting together as much as possible. He took it as a personal compliment that, at such a critical time as the present (when every member was most anxious about the stock of coal at his works), they should have come to Grays to support him, and give him the pleasure of their company on this occasion.

Mr. H. G. Ruggles (Leighton Buzzard) proposed the toast of "The Grays and Tilbury Gas Company." He remarked that, in looking through the information that had been supplied to them that morning, there were many points which proved that the Company was a most progressive and up-to-date one. But one point which seemed to stand out more than any other was the fact that in the comparatively short space of ten years, the output of gas had nearly trebled itself, or increased by about 192 p.ct. They had been able to do this in spite of the fact that a large amount of plant had had to be put down during the time, though capital and labour were so expensive. The capital of the Company at the present time was something under £1000 per million c.ft. sold. If success and prosperity were connected with an increase in business, the Grays and Tilbury Gas Company must be congratulated upon the amount of success and prosperity experienced by them in the past decade. They had been very much impressed by the up-to-date plant and machinery which the Company possessed at the works; and last year they listened to an excellent paper which their President read describing his efforts to give by high-pressure mains an adequate supply of gas throughout the large area of supply, which supply, as they had heard, had been advancing at a rate that was something abnormal. On behalf of the members of the Association, he wished to take the opportunity of thanking the Chairman and Directors for their very kind hospitality and the excellent arrangements they had made for entertaining them in Grays that day.

Mr. P. G. Gale (one of the Directors), in responding to the toast, said it was only necessary for him to say in a few words how delighted the members of the Board were to see the members of the Association present on this occasion. He trusted that those who were able to arrive in time to pay a visit to the works were able to find something there which interested them. He also hoped that they would have a successful business meeting during the afternoon. He should like personally to congratulate Mr. Sumner on having been appointed President of the Association. Knowing him as he did, he also congratulated the Association on having him for their President. He thanked those present for the way the toast had been proposed and received.

Mr. Worthington Church said it was a great disappointment to him that his Co-Director, Mr. G. C. King, was not able to be present to propose the toast of "The Visitors." He sincerely sympathized with Mr. King on not being there; and he (Mr. Church) should sympathize with the members of the Association in having to hear him instead of Mr. King, because he was a better speaker than himself. At the same time, Mr. Goodenough had been expected to be present to respond to the toast. But an important engagement in London prevented him from carrying out his original intention. Regarding the toast, he believed a visitor was one who called upon a friend to pay him a compliment. He therefore took it that the visit of the members was entirely due to the fact that not only was Mr. Sumner well known as a gas engineer and manager of this Company, but also as a man who was well known to have made many personal friends in the gas industry. Therefore the visitors were paying their President a compliment by being present on this occasion. A visitor was also a man who inspected and saw; and they had had a chance of inspecting the works that morning, and seeing something of the character of the work that Mr. Sumner had carried out there. This meeting was somewhat interesting to him (Mr. Church); for 33 years ago he attended the first meeting of the Association at Grantham. There were now very few of the old members left; but that year was the very happy beginning of his own connection with the Association, because not only was he much younger in those days, but he had in those early years of the Association made with many members acquaintance which had grown into friendship and regard. Three years afterwards he was attending the meeting of the Association in Peterborough, when he received a telegram which informed him that his wife had presented him with a son and heir. His son, who was present on this occasion [applause], had been trained under the late Mr. Thomas Berridge, of Leamington. Ever since their early days, the various Gas Associations had done an immense amount of good. The gas managers of those days were nothing compared with what they were to-day. They were more intelligent now. [Laughter.] Everywhere gas-works were cleaner and more up-to-date, and more care generally was bestowed upon them than was the case in those days. With the toast he coupled the name of Mr. Botley. In doing this, he could express the desire that the Association might increase in numbers, prosperity, and usefulness; that wisdom and knowledge might increase among the members; and that kinship and good fellowship might ever dwell among them.

Mr. C. F. Botley (Hastings) said, though a gas engineer, he found himself among them as a visitor on this occasion. In the first place, he should like to express his personal obligation to Mr. Sumner, and to the Chairman and Directors of the Grays and Tilbury Gas Company, for the great pleasure they had afforded him by the invitation extended to him to be present at this meeting. He was personally identified with the Southern Association; but it was a fact that the members of one Association intermingled very much with those of the others. At their meetings of the Southern Association in London, they were pleased indeed to see the gentleman who was now the President of the Eastern Counties Association. He (Mr. Botley) could not help saying, now that he saw the work that had to be done in a district of this sort, that it required a man of great energy, courage, convictions, and resource, to carry on the work. He was sure Mr. Sumner possessed these qualities in a very high degree. He appreciated the President as a candid critic in debate; and this was a great advantage. As a visitor, it was rather difficult to say what every other visitor would like to say; but he thought they could subscribe to the terms in which Mr. Worthington Church had proposed the toast. First and foremost, they were there out of compliment to their friend, Mr. Sumner, as he had already realized. Secondly, they were present to learn; and there was much to be learned in this wonderful district of 160 square miles. He could only hope that the time was not far distant when he should find himself in the district again as a visitor with the other visitors, who were certainly enjoying themselves very much indeed from more than one point of view. On behalf of the visitors he asked the Chairman and Directors to accept their grateful thanks and appreciation for everything that had been done for their pleasure and edification on this occasion.

BUSINESS MEETING.

The Business Meeting was held after a short interval, with the President (Mr. Arthur W. Sumner) in the chair.

Confirmation of Minutes.

The minutes of the previous meeting were confirmed, on the motion of Mr. F. W. Taylor (Ryde), seconded by Mr. C. G. Grimwood (Sudbury).

"Reports of District Gas Associations."

The Hon. Secretary (Mr. W. H. Mainwaring, of Lincoln) reported that he had received a letter from the Hon. Secretary of the Midland Association of Gas Engineers and Managers (Mr. T. Thornton) suggesting that this meeting should nominate the President and Secretary to act as representatives at a meeting to be held during the Institution meeting week to consider the question of resuming the publication of the "Reports of the District Associations."

The President remarked that of late years it had been difficult to obtain the "Reports of District Associations" (which the "Journal" used to publish), owing to their cost. The idea was that probably some arrangement might be made for an inclusive subscription, so that every member would be entitled to a copy. A suggestion had been made that the Presidents and Secretaries of the District Associations should discuss this question at a meeting to be held during Institution week. The average cost would come out much lower if all the members of the different Associations had a copy.

Mr. W. B. Farquhar (Ilford) proposed, and Mr. W. S. Venner (Brentwood) seconded, that the President and Hon. Secretary should attend the suggested meeting.

The motion was carried.

New Member.

On the motion of Mr. W. W. Townsend (Colchester), seconded by Mr. F. A. West (Newark), Mr. W. H. Ely, of Woking, was elected a member of the Association.

ANNUAL REPORT.

Mr. JOSEPH DAVIS (Gravesend) moved, and Mr. H. G. RUGGLES (Leighton Buzzard) seconded, the adoption of the annual report of the Committee. This recorded the proceedings of the past year. Towards the close, it stated that the total number of members now stood at 135. Thirteen new members were elected during the year; one member (Mr. J. Andrews, of Langley Mill) had died; and two members had resigned. As to finances, the year started with a balance in hand of £12 8s. 5d. The receipts amounted to £88 12s. 6d., and the expenses to £82 0s. 1d.—leaving a balance in hand of £19 0s. 10d.

Mr. SUMNER then delivered the following

PRESIDENTIAL ADDRESS.

Gentlemen,—I never fully realized, until I began to put pen to paper, how difficult a task it is to write a presidential address worth submitting to an assembly such as this; so that should my remarks fall short of your expectations, I trust you will not be too severe in your criticisms.

FUTURE OF THE GAS INDUSTRY.

We have been reminded on several occasions during the past two years that a great future lies before the gas industry. The late Lord Moulton, when President of the Institution of Gas Engineers, drew special attention to this, and made it clear that, although the industry had served the public well in the past, the opportunities for development and extended service would be far greater in the future. Others also have on various occasions referred to the great future of the gas industry, even in the face of keen electric competition. The point that I wish to emphasize to-day is that the great future of the gas industry, to which these gentlemen referred, lies entirely in our hands and is very largely dependent upon the action of each individual gas engineer and manager. The future is made to-day; and upon the manner in which each one of us thinks and acts to-day depends the usefulness of the industry, not only now but in the days to come.

TRAINING OF THE GAS ENGINEER.

Progress in the past has been much slower than it should have been, owing, doubtless, to the want of united effort; and it is a remarkable fact, after more than 100 years of gas making, that there are such varied opinions regarding the best methods of procedure, and especially the standard or quality which should be supplied. The cause I think is not far to seek, as up to now there has been no definite principle laid down by any authority as to the training of those engaged in this great industry. Much has, of course, been done to forward the general interests of the profession by men holding high positions; and the result to date is the formation of a number of useful bodies representing different branches of the industry. It is not, however, in a real sense the duty or prerogative of any of these bodies or associations to give special attention to the training of those desirous of taking up gas engineering as a profession. The would-be gas engineer is left to fight his own way through, and obtain such training as he may be fortunate or unfortunate enough to acquire. Such methods must necessarily lead to confusion, if not chaos, and are no doubt the cause of the diversity of opinion held on nearly every subject connected with the manufacture and distribution of gas.

It is not therefore surprising that, owing to the lack of disciplined thought, gas engineers should differ so widely in their methods regarding the production and sale of gas; but it is undoubtedly to the disadvantage of everyone concerned that such vital questions as to the quality and the nature of the resultant products are not more generally agreed upon.

A SUGGESTED HEADQUARTERS.

We look to the Institution of Gas Engineers to remedy the position, and are glad to note that they are once again turning their attention to the all-important question of the status of the would-be gas engineer. When considering this matter, I would suggest that they should go a step further, and endeavour to provide the industry with a suitable building in London, and perhaps branches in selected parts of the country, to accommodate a permanent staff of thoroughly qualified technical men, with organization and facilities to meet the varied requirements of the gas industry in all its bearings, and to take over much of the work now carried out by honorary service. This organization should be so arranged that the headquarters of the industry would become a complete house of reference on all subjects, from the purchase of coal to the latest methods of carbonization and distribution, and including all the side issues of general gas-works practice. It would then be possible for engineers and managers needing special information or advice on commercial, technical, or engineering matters at various times to obtain the services of any of the permanent staff engaged. In addition, and to this end, the experiences of, and the results gained by, managers with special plant at their works, would be collected and tabulated; and valuable information would thus always be available.

At present, information concerning new plant or methods is usually obtained through papers read by members of associations such as this, and, as a rule, the best aspect only is put forward. Speaking generally, the difficulties and failures are conspicuous by their absence. It is, of course, necessary that plant of various kinds should be experimented with; but it seems to me an absolute waste of time and money that each individual engineer should have to probe the same questions for himself. If the Parent Institution were organized in a manner such as has been outlined, gas-works in suitable parts of the country might be put at the disposal of the technical staff for the purpose of collecting reliable information, and the results obtained placed at the disposal of all concerned. Needless to say, the cost of this organization would have to be borne by the industry as a whole, and would demand the hearty support of the governing bodies of each undertaking.

Whether such a scheme as I have suggested is practicable or desirable, I must leave others to judge. At any rate, you will no doubt agree that there is an ever-growing need for closer co-operation between gas undertakings in general, and a desire on the part of gas engineers to obtain sound and reliable information regarding the best and most suitable plant to be adopted, and the proper lines on which to work, in order to produce gas as cheaply as possible, consistent with a quality which will give the best duty for all purposes.

THE GAS REGULATION ACT.

Whatever ill effects we may have derived from the past great war, it has had at least one good result—viz., that of putting us on our mettle in order to solve the many problems we have to face. Those of us who during the war were frequently put to our wits' end to maintain a supply of gas suitable for all purposes, with meagre and inferior supplies of coal, have, I believe, gained much experience that will be of the greatest value in the future—that is, assuming that the practices applied, and the results obtained, are placed at the disposal of all. Another result of the war has been to bring into being the Gas Regulation Act of 1920—partly obtained through representations made by members of the gas industry, and partly forced upon us by a Government Department. I will not venture to pass an opinion as to whether the new Act meets the requirements of the industry. I would like to say, however, that I consider that many of the clauses have been rushed through without sufficient consideration or reflection, chiefly to obtain that financial relief which is now many years overdue. The new Act is undoubtedly a step in the right direction; but I am afraid that the business of supplying gas on a B.Th.U. basis has been entered upon without due consideration as to whether gas undertakings which are starved for plant and gasholder room, and with little prospect of providing any at present high prices, are in a position to carry out the requirements of the Act. I submit that the question of financial relief and the raising of capital should have been placed in an entirely different category, and not bound up with the new standard of supply which is to be adopted in the future.

PLANT FOR MAKING HIGH CALORIFIC POWER GAS.

One of the greatest needs of the gas engineer to-day is plant making gas of high calorific power, which can be put into and out of commission at short notice to meet sudden and heavy demands. It is somewhat remarkable that blue water gas plant has not been experimented with more in this direction. Its usefulness as a plant suitable for meeting immediate heavy demands has in more recent years been recognized; but its chief drawback at the moment is the low calorific value of the gas produced. If the efficiency of this plant could be increased by 25 to 50 p.ct. (without the addition of high-priced oil), it would bid fair to become not merely a stand-by plant or diluting agent, but would go a long way to supersede the coal-gas plant in use to-day. While undoubtedly the blue water gas plant fills a useful place in gas-works practice, it is a noteworthy indication to find that many engineers are turning their attention to the question of making a mixture of water gas and coal gas, in a plant with advantages similar to those of carburetted water-gas plant.

During the past few months many of us have been watching developments along these lines, and at one time it appeared that (one might almost call it) the famous "Tully" plant was going to meet our requirements. With the prospect of being able to generate a mixture of coal and water gas in one apparatus, reducing the coal to clinker in one operation—and this with the same ease as when making blue water gas, with the resultant gas of some 450 B.Th.U.—it appeared that it might be possible to reduce gas manufacture to 12 or 16 hours per day; relying on gasholder stock for the remainder of the period. Whether, however, this plant, or a similar process, can be developed to give such results it is yet too early to determine.

For some reason gas engineers have accepted the principle that gas making must of necessity be continued the whole twenty-four hours per day, and every day in the year. Our predecessors lighted their fires, and kept them burning all day and all night, every day, and every night; and we have been content to do the same. Should we not rather spend our energies in endeavouring to devise means whereby the greater part of the night work, and more especially Sunday work, could be eliminated, both being objectionable and expensive? If it means bigger plant, and more gasholder room, let us have them; and there is no doubt that the extra capital cost would soon be met by the reduction in labour charges. Many of you may think I am romancing; but I make the suggestion for what it is worth, and in the hope that some inventive brain will get to work and overcome the difficulties in this direction.

In submitting the foregoing remarks, I have had the question of coal conservation very much in mind; and I feel that, in deciding which is the most desirable future standard for gas, coal conservation should hold a place of first importance. It would

appear from the information available that the new standard to be adopted will range from 425 to 550 B.Th.U.; and personally I am very concerned to learn the reasons prompting such a decision. It is necessary at times to take up a definite and strong position; but until more experience has been gained on this subject, we cannot be too dogmatic. It is, however, essential that we should look into the question closely, and endeavour to come to a correct conclusion.

SELECTING A NEW STANDARD.

What are the primary points demanding consideration when selecting a new standard of supply? I submit the following:

1. A suitable product that will meet the requirements of all classes of consumers.
2. Lowest cost of production.
3. Best possible results from plant available.
4. Lowest cost of distribution.
5. Coal conservation.

I cannot help thinking that many undertakings have adopted their standard on the "follow my leader" basis, without considering such vital questions as the above, and some probably through fear that a gas of a reduced calorific value will not give an equally effective and desirable service.

Having regard to the importance of coal conservation to the nation generally, it might have been expected that the Government would, irrespective of the financial benefit long past due, have allowed the gas industry (say) twelve months' grace to change over from the old set of conditions to the new thermal basis, which would have given an opportunity for closely examining and determining the proper standard for adoption, conjoined with the best method of manufacture. Instead of this, we are instructed to drop one set of rules, regulations, and penalties, and at once to take up, with little or no experience, a new set of conditions and obligations, which may prove quite as, if not more, irksome than before, with no corresponding benefit and with no stipulation as to the quantity of coal that shall be consumed in the process. In a minor degree most gas engineers have done something under Government pressure to conserve coal, by reducing the quality of the gas; and they are now generally agreed that gas of 450 B.Th.U. is capable of giving entire satisfaction to the consumer under proper supervision.

Having arrived at such a conclusion, in the interests of the community I venture to suggest that we should carry our experiments still farther, and endeavour to find the standard which will enable the industry to use the minimum amount of coal consistent with the minimum cost of production and the all-round requirements of the consumer. In a paper read before the Manchester Association of Engineers by Messrs. F. J. West and T. A. Tomlinson, the following paragraphs occur:

> The lower-grade gas could be consumed without difficulty in existing appliances, and the volume of gas required was by no means so much greater as might have been anticipated from its lower value as revealed in the calorimeter. That is to say, not only did the new gas give the same results as the old, but the efficiency was higher.
>
> A greater proportion of the calories supplied to the gas-fire or furnace was given out in radiant energy.
>
> The Gas Investigation Committee appointed by the Institution of Gas Engineers have already published three reports, based on a very large number of tests, on the subject of the relative efficiency of grades of coal gas ranging from 600 to 400 B.Th.U. per cubic foot.
>
> The gist of their conclusions is that the calorific value of gas may be reduced to 400 B.Th.U. per cubic foot without reducing the heat efficiency of existing apparatus, provided that the necessary adjustments are made to the burners, and, further, that with especially designed apparatus a considerably higher heat efficiency can be obtained with gas of a lower calorific value than with that of the higher.

From the above statement it would appear that a 400 B.Th.U. gas should be suitable for all requirements—at any rate, evidence coming from such a quarter cannot be lightly set aside.

With regard to the cost of production, this must to some extent be governed by the plant available; and the local demand for residuals must not be overlooked in this connection. At the same time, the manufacture of low-grade gas means the handling of reduced tonnage, both as regards coal and the resultant residuals, and therefore a reduction in labour charges; and this, together with the maintenance of higher prices for the residuals, tends to cheapen the cost of production. It is evident that, whatever standard is selected, most gas engineers propose to supply in future a gas of lower calorific value than before the war, and it is on the whole agreed that an addition of blue water gas is the best diluent at present. As to whether the gases should be made in two separate plants, there is as yet a diversity of opinion.

I have already referred to the fact that attention is being directed to the complete gasification of coal in a single apparatus; the gas given off being a mixture of coal gas and water gas. It is, however, possible, having regard to the value of residuals and especially tar, that it may be expedient to go back to low-temperature carbonization—making gas of a rich calorific value, and heavily diluting with blue gas to obtain the required result. If such a practice were adopted, it might be possible to arrange for the gases to mix at the outlet of the gasholder, and thus save storage plant. But this is by the way.

DISTRIBUTION OF LOW-GRADE GAS.

The question of distributing low-grade gas must of necessity arise in your minds; but here again I submit there are false impressions abroad. I have heard eminent gas engineers argue that a drop in the calorific value of gas must be followed by a proportionate increase in the size of the distributing mains; but on investigation I find that although in some instances they have been careful to reduce the inerts content in the gas, thus making more room in the mains for combustibles, they are not in a position to increase the pressure even slightly, which already stands at such high figures as 8 to 10 inches. There would doubtless be trouble with the distributing mains if the calorific value was reduced to any large extent, but I submit that the enlarging of such mains must be long overdue, and that it is not economical practice to make gas of high quality in order to maintain an effective supply at a considerable distance from the works.

Statements such as were made before the Board of Trade a little time back, that twice the quantity of 250 B.Th.U. gas would be required to do the work of 500 B.Th.U. gas, are very misleading, and likely to do much harm should the consuming public accept such statements as correct. For it must be acknowledged that gas apparatus generally was never made with such accuracy as is ascribed to it. With a rich gas it is almost impossible to obtain sufficient air at the point of ignition to consume effectively or economically all the gas supplied; but with lower-grade gas it may even be necessary to reduce the air supply somewhat, although experience has proved that it is better to enlarge the size of the gas-nipples, and also to increase the pressure, owing to the greater density of the gas. There are four important factors to be remembered when distributing so-called "low-grade" gas:

1.—Constant composition of the mixed gases.
2.—Reasonable and uniform pressure.
3.—Low inert content.
4.—Constant specific gravity (most important of all).

Unless these can be ensured, it is impossible to give satisfaction to the consumer.

GLOVER-WEST VERTICALS AT GRAYS.

Proceeding now to the domain of orthodox gas manufacture, I should like to submit a few particulars regarding the installation of vertical retorts at Grays. Vertical retorts are now fairly generally in use, and many papers have been read before this and similar Institutions describing their method of working, and the results obtained; but so far I believe the question of the cost of repairs and maintenance has been generally omitted. No doubt figures relating to this matter would be of general interest, and I feel that it will not be out of place to submit to this meeting some details of our costs under this head. In 1912, it became necessary to consider the question of additional coal-gas making plant, and after visiting various works, and carefully considering different forms of settings, it was decided, having regard to all circumstances, including that of ground space, to instal vertical retorts. An order was therefore placed in 1913 with West's Gas Improvement Company for a complete installation of Glover-West settings, having a capacity of 500,000 c.ft. per day. At this time our make of gas was about 88,000,000 c.ft. per annum. It was therefore necessary to adopt a retort of the smallest possible capacity, as each retort represented a large unit for so small a works when putting in and out of action.

The scheme submitted by West's Gas Improvement Company, and eventually adopted, consisted of a suitably constructed steel-framed house, containing 16 retorts, each of 2½ tons capacity per twenty-four hours. These were placed in two lines and divided into four beds, each four retorts having a separate generator furnace. The coal-bunker, running the length of the retort-house over the top of the retorts, is of 40 tons capacity; the coal being elevated by means of a gravity bucket conveyor. The extracting gear is arranged at one end; and a small engine-house adjoining the retort-house is fitted with a 20-H.P. gas-engine for elevating the necessary coal and coke, and a small 3½-H.P. gas-engine (in duplicate) provided for driving the extracting gear.

The furnaces are of the step-grate design, and the coke-bunker, of 6 tons capacity, is placed overhead in a suitable position for feeding the furnaces. The foregoing particulars are given so that you may have a general impression of the plant.

The order was placed in 1913, and the work was commenced in April, 1914, and completed ready for gas making in September, 1914.

The cost of the installation was as follows:

Cost of vertical retort-house and four beds of four retorts each (16 retorts in all) having a capacity of 2½ tons per retort per day . . .	£8911	5	6
Foundations	597	0	0
Coke for drying settings	130	1	9
Capital expenditure . . .	£9638	7	3

Eight retorts were put to work on Sept. 14, and the remainder on Sept. 26, 1914. The quantity of coal carbonized in these retorts from September, 1914, until they were let down for repair in 1920, was 56,465 tons. The cost of repairs during the whole of the above period, including the cost of putting the installation in

as good repair in every respect as when first started to work, is shown below:

	£ s. d.	£ s. d.	£ s. d.
1914 Cost of spare parts held in stock for emergency	44 6 0		
Labour (own men)	14 5 6		
1915 Small repairs executed, materials, and labour	119 9 7		
1916 (Year of breakdown.) Cost of resetting 16 retorts and relining furnaces, materials, and labour		838 16 6	
Additional small repairs, materials, and labour	155 6 6		
1917 Small repairs, materials, and labour	96 11 3		
1918 Small repairs, materials, and labour	101 16 3		
1919 Small repairs, materials, and labour	114 8 8		
Materials put into stock in preparation for resetting at later date			297 9 3
1920 Materials and labour for repairing eight retorts and relining two furnaces			792 2 0
Materials and labour for repairing eight retorts and two furnaces (and including cost of 16 new coal hoppers, £444 11s.)			1223 0 0
1921 Completing the above repairs			596 16 7
	£646 3 9	£838 16 6	£2909 7 10

Cost of general upkeep	£646 3 9	or 2·74d. per ton of coal carbonized.
Cost of 1916 breakdown	838 16 6	,, 3·56d. do.
Cost of renewals in 1920-21	2909 7 10	,, 12·36d. do.
	£4394 8 1	,, 18·66d. do.

It will be noticed that since the installation was put down, the whole of the retorts have been twice renewed. The first occasion was in 1916, when they had only been in use some 18 months. This was a most unfortunate occurrence, and was not, I believe, peculiar to Grays alone, and cannot fairly be taken into consideration when comparing the cost of renewals with other forms of settings. The explanation for this early breakdown was, I think, due to three different causes:

1.—The unequal expansion of the retorts as compared with the rest of the setting.
2.—That men having only horizontal retort experience were transferred to the new system, and did not grasp the new method of carbonization, or even realize the importance of complying with the detailed instructions.
3.—"Overpulling" in the retorts, although this never exceeded 3-10ths at the inlet of the retort-house governor.

The latter, however, was sufficient to draw in furnace gases through small cracks in the sides of the retorts, setting up local heating and forming clinker to a sufficient extent to stop the movement of the coal. Each time this occurred the condition of the retort was made materially worse, and was, in fact, in conjunction with the two first causes suggested, ultimately sufficient to ruin the retorts.

The first difficulty is now overcome by inserting small strips of wood between the retort tiles and the retorts themselves, when they are being reset. On lighting up, the wood burns out, leaving the retorts free to expand in all directions.

With regard to the third cause, particular attention is now paid to ensure that overpulling shall not take place, and the governor is set to give a straight line on the zero mark on the recording chart. This is a most important point when using vertical retorts; there being no liquor seal to the ascension pipe.

I would also ask you to remember that the repairs referred to have been carried out during a most expensive period, both as regards materials and labour, as is evidenced in the costs already submitted, and for the purpose of comparison with pre-war costs should be divided by not less than 3. In addition, no opportunity has been afforded for selecting suitable coals for this class of setting; supplies having been obtained through four factors, each furnishing three or four different kinds of coal, and on the whole of an inferior quality and unsuitable for our requirements. This not only affects the results obtained, but has also had an adverse effect on the life of the retorts, as it has necessitated changing the heating conditions frequently.

I do not propose at the present time to give details of the results obtained, except as regards labour. When the installation was first put to work, one man per eight-hour shift was employed, and the cost per 1000 c.ft. of gas made was about 0·6d. Owing, however, to the change-over from peace to war conditions, two men per shift are employed, and with the increased cost of labour the cost per 1000 c.ft. gas made now stands at 3·15d.

As already stated, the coal and coke is elevated, and coke extracted, by means of gas-engines. The quantity of gas used for this purpose from September, 1914, to March, 1920, was 4,658,000 c.ft., or 82 c.ft. per ton of coal carbonized. When it is remembered that 18,000 to 20,000 c.ft. of gas are made per ton of coal, this quantity is very small indeed.

DISTRIBUTION AND SALES.

Turning to the distribution of gas, is it not time we gave more serious attention to this important branch of our work? It is no uncommon thing to find quite large undertakings insufficiently staffed in what is termed the distribution department. In fact, many of them think it quite unnecessary to engage a properly-qualified official to take charge of this work under the supervision of the Manager; and frequently this most important branch of the industry is left in the hands of the foreman fitter—it being obviously impossible for the Manager to give it the necessary attention. Surely, in any circumstances, this is a most short-sighted policy. It is no use making gas unless we can sell it; and having regard to the many ways in which gas can be used, and to the need for constantly bringing the usefulness of gas to the notice of consumers, it is becoming more and more important that the distribution department should be given special attention.

Some twenty or more years ago, the question of providing showrooms became almost a craze amongst gas companies, and now even the smallest company can boast a showroom. But what does it really amount to? With the exception of providing office accommodation, they are largely a dead letter, and frequently serve no useful purpose. Here and there gas apparatus is brought to the notice of the public; but for the most part they seem chiefly to exist to accumulate dust, and seldom can it be claimed that, as showrooms, they pay.

As regards the district superintendent, there is not the slightest doubt that a really good official in this department does pay; and I feel that if the industry is to be successful in increasing the sale of gas, such men must be found and employed. To-day there is a greater need than ever before for such men, and with the changes that must of necessity come with the introduction of the new Act, it is of the utmost importance that men of intelligence should be appointed to take a really live interest in increasing the sale of gas—men who can be relied upon to see that proper gas apparatus is installed and adjusted, and the consumer enabled to get the best possible results.

Now that the restrictions of D.O.R.A. are removed, public and shop lighting is again coming into its own; and with the existing high price of gas, it is more important than ever that proper and expert attention should be given to consumers' requirements. This can only be done by employing a fully experienced staff with a suitable man in charge. I am convinced that much business, and the resultant revenue, is lost to the gas industry by neglecting the distribution and sales department.

EDUCATE THE CONSUMER.

Another side which is often overlooked is the education of the consumer in the use of gas apparatus. This, if it needed confirmation, would easily be demonstrated by the crude manner in which consumers express their complaints. They still believe the gas meter to be an inveterate liar, that gas managers persistently put air in the gas, that gas lighting is injurious to health, that gas-cookers spoil cooking and that meat tastes of gas, that anything wrong with the cooking is the fault of the cooker and not the cook, that gas is responsible for dirty ceilings, that gas companies pay unduly high dividends, that the gas manager has a "cushy" job, and a host of similar irresponsible statements. It is really surprising that, after over 100 years of existence, the gas industry should be so misunderstood. But whose fault is it? And has the industry as a whole done anything to eradicate such impressions? How many men on our staff could cook a dinner in a gas-cooker after it has been prepared, or explain the reason for the dirty ceiling, or adjust a cooker or gas-fire, or prove that meat or other food is not contaminated when cooked in a gas-oven? We leave such matters to the office boy or the fitter to deal with. We ourselves have no time, generally speaking, and do not employ anyone to devote his attention to these matters.

If the above is true—and I believe it is—then is it not time that such conditions were amended, and a thoroughly capable staff employed? Personally, I feel that any gas employee who comes in contact with the consumers should be trained to deal with their requirements efficiently. Much good work is being done in this direction by the B.C.G.A.; but there is considerable leeway to make up, and any one who may be interested would do well to get in touch with that Association, who will be able to give expert advice, being constantly in touch with this side of the business. It is certain that unless we do give these matters our attention we shall lose ground, instead of attaining that high place which we feel the gas industry richly deserves. With regard to consumers' complaints, I am afraid most of us look upon them as a nuisance, and something to be avoided if possible; the idea being that, when the service is laid, and the meter and various gas apparatus fixed, all that remains to be done is to collect the account. In other businesses, when an article is sold, the shopkeeper's responsibility is finished. Not so for the gas manager. The consumer is like the poor, always with us; and whenever we will, we may do him good. As a rule, however, after putting on a consumer, we are content to sit down and await a complaint before doing anything further.

We may advertise our wares in different ways, and be ready to give help and advice when required to do so; but do we go out of our way to find out whether the consumer is satisfied and is making the best use of the apparatus installed? The answer is

in the negative. We expect the consumer, no matter who he or she may be, to know all about gas; how it will act under different circumstances and in different apparatus, and also when it is working properly and giving good results. Is it not time that such work was systematically undertaken by experienced gas employees, and periodical calls made, to ascertain whether the appliances are working satisfactorily and if any attention is required? Use should also be made of the same official to leave suitable literature, or take orders for new or additional apparatus; the result being a satisfied consumer and increased gas consumption. Personally, I think this matter is chiefly summed up in the fact that we are too anxious to obtain new consumers and not sufficiently anxious to retain and satisfy those we have. It is essential to bear in mind the all-important B.Th.U.; and as the life of the industry will in future depend on it, it is more necessary than ever that gas apparatus should be kept up to concert pitch and the best possible use made of the product we supply. I am confident that the supervision of the district is one of the most important factors in the life of the industry, and we must not allow the manufacture of gas to absorb all our attention.

THE GAS-METER.

Much attention has of recent years been given to the dry gas-meter—perhaps more particularly since it has been more or less common practice to use blue gas in fairly large percentages—and many engineers have emphasized the necessity of introducing oil for the purpose of keeping them lubricated, and thereby saving the leathers. Is this the correct view to take, or is it not the right course to adopt to set about finding a suitable material to take the place of the leather, or, better still, to alter altogether the construction of the meter, which, I think everyone will admit, is now quite out of date—being too large and too expensive, both as regards first cost and upkeep? It surely cannot be beyond the wit of man to devise some more suitable meter, and perhaps one that will register B.Th.U. Why we must make gas to suit meters and other apparatus, I cannot understand. Surely the first consideration is to decide the standard and quality of gas required, compatible with the cost of production, and then to find apparatus suitable to measure and burn it.

GAS APPARATUS AND BURNERS.

In conclusion, I would like to say a word regarding the manufacture of gas apparatus. If the gas industry is not to be hampered in the future, makers of various gas apparatus must give more attention to the requirements of the gas industry. The advance made with gas cookers and fires has indeed been very slow. The requirements of the consumer are not sufficiently studied. Attention should also be given to the utilization of the waste heat from cookers to produce a limited supply of hot water, which is constantly required in the home. Again, when is some new device going to be brought forward with regard to grilling? The chef in large hotels does his grilling over the heat; the cooker manufacturer insists that it shall be done upside down—consistent, apparently, with other peculiarities in the gas industry. With regard to gas-fires, there are devices for regulating the gas and air supply; but, in nine cases out of ten, they are so arranged that they cannot be got at when the fire is in position, and frequently the fire has to be disconnected and the adjustment done by guess work, to say nothing of the waste of time involved

Then regarding the gas-burner, before the war it was possible to obtain an upright incandescent gas-burner for 2½d. and an inverted burner for 6½d. To-day the prices are higher; but, if anything, the quality is inferior. This was and is a disgrace to the industry, and everything possible should be done to keep such rubbish off the market. I suggest that all burners before being placed on the market should pass a Board of Trade or similar test, as undoubtedly many complaints regarding gas lighting are directly attributable to the inferior burners in use. If more attention is not given to the production of suitable burners, it will not be long before the lighting load will be reduced to a minimum in view of keen competition. Undoubtedly the time has come when we have to look to our laurels—when there is work to be done, and a keen competitor to face.

I feel, therefore, that I cannot do better than close my remarks by using words smilar to those used both by our King and our Prince: Gas men, wake up. Gas men, pull together!!

At the close of the address,

Mr. A. E. BROADBERRY (Tottenham) said a very pleasant task had been placed in his hands. It was to propose a vote of thanks to Mr. Sumner for the splendid address he had just delivered. Writing a presidential address was not an easy task. It required a great deal of thought, and a great deal of care. One had to be careful to say all that one wanted to say, and to refrain from saying what it was better should be left unsaid. They had had just the address they expected from Mr. Sumner. He had taken a wide view over the whole industry; and he had spoken his mind, and their own. He had told them things that would set them thinking for a long time to come; and they would often refer to the address he had delivered, in order to think again over some of the points of wisdom that he had given them. He had with a great deal of candour told them of costs with regard to his works, which a great many of them preferred to keep to themselves. (Laughter.) He had put these very plainly and very candidly; and he had set them a good example in this regard. He had also passed some severe strictures upon them with respect to the way they carried out their duties in connection with the consumers; and he (Mr. Broadberry) thought it behoved them all to think over whether they should plead "guilty" or "not guilty" to the charge. If "guilty," they should think how they could mend their ways. The President had also given the manufacturers something to think over. Among all the points there was a great deal of seed for good development in the future. He therefore proposed, on behalf of the members, a hearty vote of thanks to Mr. Summer for his address.

Mr. W. B. Farquhar (Ilford), in seconding the motion, associated himself with the remarks Mr. Broadberry had made.

The motion was carried by acclamation.

The PRESIDENT thanked the members very much for the vote of thanks. He confessed that he did not find it an easy task to write a presidential address. He did not know whether it became easier or harder, as the years went on, to write addresses. But just at the present time, everybody appeared to be waiting for someone else to give a lead; and so it was difficult to write in such a trying time as that now before them.

RECONSTRUCTION WORK AT NEWARK.

Mr. F. A. WEST (Newark) read a paper on the above subject. An important part of it dealt with experiences with the Tully plant. The paper and a report of the discussion are published on later pages.

The PRESIDENT (before taking the discussion) said he should like to propose a very hearty vote of thanks to Mr. West for the paper. The information the author had given the members showed he had done quite a fair amount of work in the last three or four years. He sympathized with him in the fact that it had been a most difficult thing to know what was best done in such trying circumstances as they had passed through, and having regard to the fact that the consumption at Newark, like that at Grays, had grown so rapidly.

Mr. RUGGLES seconded the motion, and it was carried with applause.

ELECTION OF OFFICERS.

The President proposed that Mr. Ruggles, of Leighton Buzzard, be elected President for the ensuing year. He did not take office until October; but it was necessary at this meeting that his election should occur. The name of Ruggles had long been connected with the gas industry; and this was sufficient for them to know that their friend would be quite a good man in the presidential chair.

Mr. J. DAVIS (Gravesend) in seconding, said he had known Mr. Ruggles from his initiation as a member of the Association. He was a man of high integrity, and would fill the chair admirably.

The motion was carried with applause.

Mr. RUGGLES thanked the President and Mr. Davis very heartily for their proposition, the members for the way they had received it. Anything he could do to maintain the efficiency and high standard of the Association, he should be pleased to do. He trusted that next year they would meet in circumstances happier for the gas industry than they were that day.

Mr. C.G. GRIMWOOD (Sudbury) proposed that Mr. T.F. Canning be elected Vice-President. The Association had now been in existence for over thirty years; and they would look back with pride at the long list of names of Presidents who had occupied honourable places in the industry. Their Vice-Presidents in due course succeeded to the presidential chair; and they would be glad to see Mr. Canning's name added to the list of Presidents.

Mr. W. W. TOWNSEND (Colchester), in seconding, said that Mr. Canning would make an excellent President when his turn came to serve in the office. He thought the Committee were to be congratulated on having secured his acceptance of the position. Mr. Canning had not been long in the district; but in this Association they did their best to make newcomers feel at home among them. When Mr. Canning's time arrived to take the chair, he was sure the members would be satisfied with what he would do to maintain the record of the Association.

The motion was very cordially agreed to.

Mr. CANNING said he should like to say how much he appreciated the honour the members had conferred upon him in electing him their Vice-President. He also appreciated the kind remarks that had been made by both mover and seconder. All he could say was that he would endeavour to carry out the duties of the office to the best of his ability.

The PRESIDENT said, although Mr. Mainwaring had only been their Hon. Secretary during the past twelve months, they had been so much in touch with each other that he (the President) could testify as to the efficiency with which Mr. Mainwaring had carried out his new work. He had, therefore, much pleasure in proposing that he be asked to continue in the office during the coming year. He could assure Mr. Ruggles, from his own personal experience, that their Hon. Secretary would keep him "up to the scratch." This being so, Mr. Ruggles would not fail in his duty.

Mr. FARQUHAR seconded the motion, which was heartily agreed to.

The HON. SECRETARY, in thanking the members, said he should endeavour to do his duty better next year than last.

The PRESIDENT said he had a letter from Mr. Beale, who was now 80 years of age, and who thought the time had come for him to resign office as one of their Auditors. Mr. G. A. Mallett, of Ipswich, was the other Auditor. He (the President)

had pleasure in moving that the best thanks of the members be sent to Mr. Beale for the work he had done for the Association; and that Mr. Mallett and Mr. W. S. Venner (Brentwood) be asked to accept office as their Auditors for the ensuing year.

Mr. J. DAVIS (Gravesend) seconded the motion, which was unanimously carried.

The PRESIDENT proposed that Mr. E. F. Keable, of Southtown, Yarmouth, Mr. H. Green, of Stamford, and Mr. J. R. Bradshaw, of Retford, be elected Members of the Committee in place of those retiring.

Mr. F. A. WEST (Newark) seconded the motion, which was adopted.

PLACE OF NEXT MEETING.

The PRESIDENT remarked that the Committee were at present of opinion that the place of next meeting should be London; but perhaps it would be better in the circumstances to leave the matter in the hands of the Committee to deal with when they got closer to the time for holding the meeting.

The suggestion was agreed to.

A VOTE OF THANKS.

Mr. G. R. CASTERTON moved a vote of thanks to the President and officers for their services. He said though they had been engaged in electing new officers, they must not forget the services of the old ones; he would therefore ask the members to thank them sincerely for what they had done.

Mr. VENNER seconded the motion, which was heartily agreed to.

The PRESIDENT thanked the members, on behalf of the officers and himself, for their kind recognition of their services. For the officers, he was able to say that they had done their work well, and had been most assiduous in attending the meetings. He wished before they parted to thank the members for having turned up in such numbers. It had been a great worry to him during the week to decide whether or not it would be the correct thing for him to cancel the meeting, and wait for better times. He was very pleased to see such a meeting; and he was thankful to those present for having left their works in such difficult circumstances to come to it, and so support him.

This concluded the proceedings; and the members had tea together before separating for home.

SOME RECONSTRUCTION WORK AT THE NEWARK GAS-WORKS.

By F. A. WEST.

[A Paper read before the Eastern Counties Gas Managers' Association, April 27.].

When approached to give a paper to the Association, I felt rather at a loss what subject to select. It is a difficult matter to produce anything new and interesting, unless one has been fortunate (or unfortunate) enough to become a pioneer in the manufacture or distribution of gas. Sometimes the most useful part of a paper is the discussion which follows. At any rate a frank discussion, without fear of upsetting the contributor, certainly tends to do that individual some good, by impressing upon him the fact that his particular ideas are not the only solutions to his difficulties. With this object in view, therefore, I came to the conclusion that perhaps a general paper on the reconstruction of the Newark Gas-Works, with a description of some of our troubles, successes, and failures, would afford room for discussion and be of some interest to the members.

When I was appointed to Newark about three years ago, the works were in urgent need of repair, and the retort-house, in particular, was in a very bad condition. There had been some thought of erecting a new works on a new site, and extensions had been delayed. With the rapid increase in the price of all materials, &c., and the difficulty in obtaining capital, the new works theory was finally abandoned, and we decided to extend and reconstruct the works on the existing site—a policy which would also give us some immediate relief over our labour difficulties. The question immediately arose as to the best solution, from the point of view of producing gas most economically. We had two retort-houses—one containing direct-fired settings and the other five beds of through regenerators. Vertical retorts to replace the direct-fired settings were first thought of, but had to be abandoned on the ground of capital cost. We are a sliding-scale Company; and our dividends at that time were not attractive enough to enable us to issue a large amount of capital. Everything in the works was done by hand labour; and the difficulty of obtaining efficient stokers was so great that we installed a stoking machine and coal-handling plant to commence with.

We employ a retort-setter of our own; and this enabled us to put the regenerator settings into fairly good condition for a few more years. The ironwork was the great trouble in this section. The foul mains were far too small; and this implied excessive vacuum to get the gas away, with a resultant poor quality.

The installation of the stoking machine, generating plant, and coal-handling plant cost about £6000. We saved nearly £2000 in stokers' wages the first year; but, apart from this, we could not have carried on without it, as we were increasing so rapidly. We erected a fairly large engine-house for the generating plant, to allow for a larger set at a future date, and other items. We also constructed a railway siding into the works, across the street from an adjoining goods yard. The outlay on the siding, which runs directly over the elevator coal-hopper, amounted to £450. As it cost us something over £1,000 a year to cart our coal into the works, it was a good investment, as the Railway Company put our coal into position without charge.

While this work was going on, we made all the gas out of the direct-fired settings. These were in a very bad condition, and we absolutely took the last ounce out of them. They are a heap of scrap now, and will shortly be pulled down and the retort-house used as a coal-store. At present we only have very limited storage, and are forced to stock coal in small heaps all over the works.

We obtained a new Act in 1919, and among other clauses, adopted a calorific standard of 500 B.Th.U. We also scheduled for manufacturing purposes a further considerable proportion of land, which we purchased, with 28 houses surrounding the works. The rent from the houses pays the interest on the capital outlay; and we absorbed half of the gardens to make room for new purifiers and an oxide yard.

We continued to increase very rapidly; our output growing from 100 to 160 millions in three years. The result of this was to put an abnormal strain on all our plant during the winter months. I discovered that it was impossible to manufacture gas of a higher quality than 425 B.Th.U. gross during the winter period; and as it was undesirable to supply a low-grade gas at one time of the year and a higher grade during the summer, we decided to maintain a 425 B.Th.U. gas always. The result, after adjusting apparatus in the town, was quite satisfactory; and the fact that we endeavoured to supply a constant quality gas was appreciated by the consumers. We increased the pressures from 28-10ths to 38-10ths, and were unable to go above this, as we have a considerable number of wet meters. For the first 18 months that we worked on these lines we had no water-gas plant—our coal gas was simply stretched with inert gases. This was very bad practice; but we had no alternative if we were to maintain the supply of gas to the town. We are paying for this now by reason of a comparatively large leakage, due almost entirely to dry meters registering slow.

To relieve temporarily our purifying difficulties, I purchased a Sadler-Cockey centre valve, to replace an old-type centre valve working three boxes on and one off. With the new valve we could work four boxes on the backward or forward rotation system.

We purchased the castings for two new purifiers, 25 ft. square, and also a Livesey washer to pass a million c.ft. a day, in the early summer of last year, and erected these ourselves. They were a welcome addition; and we have no difficulty in producing a clean gas now. The amount of money saved in erecting was considerably more than enough to pay for the Livesey washer

INSTALLATION OF A TULLY PLANT.

My next thought was how to produce more gas. We had no room to extend the retort-house, and it was practically impossible to construct regenerators in the direct-fired retort-house, which was not wide enough; and I was not anxious, for economic reasons, to reset any of the direct-fired settings. The first and obvious solution was a water-gas plant, and after much thought and investigation I decided on a "Tully" carburetted hydrogen plant—chiefly for the reason that it was more flexible than an ordinary water-gas plant, inasmuch as coal or coke and comparatively cheap oil can be used for enriching. This plant we placed alongside the direct-fired retort-house, in an existing coal-shed. By carrying up the roof and making a few other structural alterations, we made a very suitable water-gas plant house with convenient room for extensions in the future. We now have two 300,000 c.ft. sets, with two Hodges steam turbine blowers, two water pumps, and an elevator engine and a steam oil pump in a separate engine-house. An ordinary elevator is used to elevate the coal or coke on to the stage floor. I decided that the capital expense of overhead bunkers and automatic charging would not be justified in our case. One generator only was erected at first.

We installed a new Lancashire type boiler, 28 ft. by 7 ft., fitted with a Wilton furnace, new feed pump, and feed-water heater. This was erected on a new site with a new brick chimney, and provision has been made for duplicating. A new boiler-house has not been built yet, but a temporary corrugated iron roof thrown over until the other boiler is erected. A main exhaust pipe has been laid in the works for all exhaust steam to feed into. This is connected to the feed-water heater, and all the condensed water will be filtered and recovered and mixed with our boiler feed water in order to reduce the hardness and avoid the necessity of installing a water softening plant. When the other new boiler is erected, the two old Cornish boilers, which have been in use forty years, will be dismantled and employed as an overhead water-tank, and the house containing them will be used to extend the adjoining exhauster house, which is very congested.

A building in the works has been converted into a mess room, complete with baths, wash-hand basins, and lavatories for the men. We have also fitted up an excellent laboratory—perhaps for a works of our size a little beyond the usual standard; but I am convinced that it has been a wise investment.

Early last winter our station meter had to be bye-passed, as

its capacity was only 20,000 c.ft. per hour, and we were trying to pass over 40,000 c.ft. at times. After considering the cost of a new meter to pass 60,000 c.ft. and a new house, about £3500 altogether, I decided on a "Venturi" meter, at a cost of less than £600. This could also be comfortably housed in our existing meter house. These meters will probably be used frequently in the future, as they apparently have many advantages over the usual drum type.

Naphthalene.

We experienced, among other difficulties, considerable trouble with naphthalene on the district. This was probably the accumulation of years, as nothing had ever been done to prevent it. The trouble was so acute that we averaged nearly 1000 complaints a month among less than 4000 customers, and I decided that something had to be done immediately. I had tried vapourizing paraffin, &c., with steam in other places, and had formed the opinion that unless one had high-pressure steam available it was not a success, and even then it left much to be desired. I had no high-pressure steam at that time—it was before we installed the water-gas plants. I purchased a small gas compressor from the Bryan Donkin Company, and one of their new sprayers, which I believe was originally designed by Mr. Doig Gibb. The whole apparatus cost £128 complete. The paraffin is dripped into a small annular tube, fixed into the centre of the main, and the high-pressure gas, about 25 lbs. to the square inch, is blown over the surface of it down the inner tube. The outer tube has a hole about 0·2 in. on the centre line of the main, and the inner tube a hole about 0·1 in. It absolutely atomizes the liquid used, and carries it forward to the extreme ends of the district—even into burner nipples. The result was extraordinary. Our complaints dropped immediately round the works, and gradually got farther and farther away until finally they almost disappeared. I think that perhaps I derived as much satisfaction from that simple apparatus as from anything I have ever erected anywhere. We used about 4 gallons of benzole per million cubic feet at first, and then gradually reduced this to 1 gallon as the complaints got less. It was suggested to me that our naphthalene complaints had fallen off through using water gas, and I stopped the compressor for four months. Complaints gradually began to come in again, so I decided to continue using about 1 gallon of benzole per million always. This does not cost much, and does a lot to prevent internal corrosion if it is not required for naphthalene. The mains, where we have cut them, are coated inside with a very fine oily film. We test occasionally for naphthalene, and it averages about 2 to 4 grains per 100 c.ft.—not much, but perhaps sufficient to cause trouble in time.

As one can easily imagine, with a distributing system in such a condition a properly constituted department was imperative, and was soon organized. We purchased an army hut; and after fitting up with proper bins, &c., it has made an excellent stores at a cost of about £150. We engaged a storekeeper, and adopted the card system of storekeeping—one card for each different article in stock. It is an excellent system, if properly kept. We appointed a Distribution Superintendent, and put him in entire charge of the department, which is now well established. We have a good staff of fitters, and do a large quantity of the gas-fitting work in the town, besides the usual free work and complaints, &c. We make a special point of training our fitters in the theory of distribution and the use of apparatus, and pay them to attend lectures once a week, so that they can talk to consumers intelligently. Naturally the average consumer forms his opinion of the gas company from the distribution staff, as they are usually the only officials he ever meets. We are handicapped by not having a good showroom; but, on the other hand, we are not able to advertize and push gas sales to any great extent until the works are capable of supplying our present output satisfactorily, with a margin for further increases. However, the Distribution Department has more than justified itself, as shown by the increase of 60 p.ct. in three years.

A Reconstruction Problem.

Probably the most difficult job we have to contend with is the reconstruction of the retort-house, as there is very little room to extend in any way, and what is necessary will have to be done while the bench is at work. I should like to pull down the existing regenerators, and erect in the space available six beds of eight large retorts, which would give us a retort-house of 1 million a day capacity, or three times that of the existing bench on practically the same ground area. The estimated capital cost complete, with new retort-house and expensive coke-handling plant, &c., is so great that we have had no alternative but to postpone this for the present, until we can issue more capital economically.

In the meantime, we are installing another carburetted hydrogen plant of ½ million capacity, duplicating the boiler, and erecting new water-tube condensers. I am making some alterations to the foul main and hydraulics on the existing bench, to enable us to manufacture a high-grade straight coal gas, and bring this away in one stream instead of two. My idea is to make perhaps 50 or 60 p.ct. of carburetted hydrogen gas, and enrich this with a good coal gas, as oil is prohibitive at present. The gas from both plants will be brought away at as high a temperature as possible. The coal-gas plant will be worked without seals and the vacuum regulated by the retort-house governors only, about level gauge in the retorts. The two gases will then be passed together through a series of two or three small tar-extractors, filled with Lessing's rings and heated further if necessary by a steam jacket on the outside, with the idea of removing the heavier tars and leaving all the benzole and lighter hydrocarbons in the gas, considerable quantities of which are usually carried away or washed out by the tar during the time the tar and gas are travelling together and gradually condensing. The heat scrubber will probably remove dehydrated tar direct, without the necessity of a separate plant. The gas, after leaving these, will be gradually cooled in the usual way by ordinary water-cooled condensers. It is hoped with this system to mix a very large percentage of carburetted hydrogen gas and maintain a good calorific value. The gas leaves the carburetted hydrogen plant at a temperature of about 750° Fahr., and probably the temperature of the coal gas will be from 350° to 400° Fahr.

If this method is successful, we shall lag the foul mains from both plants to conserve as much heat as possible. The carburetted hydrogen gas which goes into the relief holder may be heated in the same way, with the addition of a small sulphuric acid washer to catch any ammonia that is lost in our present system. It must be remembered that carburetted hydrogen gas is very different from ordinary water gas. It contains a fair proportion of methane, from 3 to 14 p.ct., and a small percentage of heavy hydrocarbons, 0·5 to 1·5 p.ct. The flame temperature is very high; and nobody was more surprised at the results in incandescent burners (which are most brilliant) than myself. We have a very large industrial consumption—over 200 gas-engines, and many furnaces of different types; and I am inclined to think that a 425 or 450 B.Th.U. mixed gas is the most economical and suitable for our particular district.

Experiences with the Tully Plant.

Several interesting papers have been written about carburetted hydrogen plants within the last year or so, so it will not be necessary for me to describe the plant in detail. Some of our experiences, however, may be interesting. Normally we use coal, but sometimes mix a little coke to prevent "hanging." A small proportion of coke also helps to increase the carbon content of the generator, and consequently increases the output, if the coal in use is low in fixed carbon. We roughly test a new coal, to make certain that it will go through the plant, in the following way: We take (say) 1 gram, and mix it with an equal weight of sand; if this cokes, we call it a coking power of 1. We then mix it with 2 parts of sand; if this cokes, we call it a coking power of 2, and so on. We find in practical working that almost any coal with a coking power of 1 will go through without "hanging up," and that most coals with a coking power of 2 will go through; but a coking power of 3 usually requires some coke with it.

It must be borne in mind that coal travels through these retorts much faster than through an ordinary vertical—perhaps three times as fast; so that during the period of passing through what might be called the sticky stage, the coal has to move more rapidly and a greater distance. The gas produced, of course, varies according to the length of blow, amount of steam, and period of steaming; and it largely depends on each individual works what is the economical limit of quantity and quality. Care must be taken, as with all other water-gas plants, that all valves are tight to obtain constant results, and steam must be regulated to suit the fuel used. Wet coal will naturally send the CO_2 content up alarmingly. We test regularly for CO_2, as it gives a very good indication if the steam is in excess or not. There is no difficulty with proper supervision in keeping the CO_2 content down to 4½ or 5 p.ct.

We have discarded the step-grate furnace for an ordinary flat bar grate in one generator and a hipped bar grate in the other. The hipped grate is undoubtedly the better; it rises about 4 in. from the bottom of the furnace door to the centre. This gives a larger grate area and a larger output. The step grate would probably be all right in a larger plant; but with a comparatively small generator it absorbs too much of the grate area with solid brickwork to give the results the ordinary grate does. Another advantage is that the hipped grate has a tendency to induce the blast to go through the centre of the fuel, and prevents clinker creeping up the sides of the generator. When steaming downwards, we pass a small quantity of steam through the top of the retort; the bulk going through the surrounding chequer work. This assists in clearing out any coal gas in the retort on the down run and makes a slight difference to the quality. Clinkering is a comparatively easy job when using coal, as practically no clinker is formed. It is only a case of removing ashes and pricking up. Of course, when using coke the ordinary clinker is formed as with any other water-gas plant. It is a point of interest that we gain anything from 80 to 100 B.Th.U. by passing the hot carburetted hydrogen gas direct into the coal-gas foul main.

In March last year, we duplicated the plant as the best means of obtaining more gas for last winter; and also as this plant had now developed into an important producing unit, and not an auxiliary, we felt that duplicating would make our position a little safer. We took the opportunity of making a connection between the two units, so that the gas could be generated first in one producer and then passed through the other to fix it, with, we hoped, a possibility of improved results. We worked the two generators in every conceivable way—steaming first one and then the other, and steaming both together in varying proportions; but the results were practically the same as when working one generator only in the usual way, with the added disadvantage of obtaining very little more than the output of one generator only instead of two. After some weeks' experimenting, we finally abandoned the twin generator system, as we had some difficulty

in keeping tight the valves which connected the two together, and there were grave risks of a serious explosion. We then operated as originally intended—one at a time.

I experienced no difficulty in getting our operators to work both plants together, as they are arranged conveniently for this; but after watching them for some time, I found that sometimes they got a little mixed with their runs and blows when working to one clock. This can be quite understood, as naturally the operator has not very much spare time to consider whether he should be on an up or a down run or blowing. We purchased two clocks, and had the hour hands taken off, and the large hands, which complete the circle of the clock in one hour, left on. On the dial we placed a chart divided into sections and painted different colours, so that a space of (say) 2 minutes was red—this represented a blow; a further space of (say) 5 minutes was black—this represented the run; and on an inner circle we painted a space equal to two runs blue—this represented a down run; another space equal to one run yellow—this represented an up run. I must admit the effect is somewhat startling at first glance, but they are splendid indicators. The operator or anyone else can see at a glance exactly at what period either of the plants is working; and another advantage is that, instead of instructing operators to alter the duration of blows and runs, you simply put on another chart to suit your requirements, with confidence that your instructions are being carried out more or less automatically. There are recording gauges for operating and for steam pressure.

When duplicating this plant, we used our coal-gas plant only, and were making a 440 B.Th.U. gas for reasons I have previously stated. We then started mixing carburetted hydrogen gas with it in the foul main hot, without making the slightest difference to our coal-gas manufacture, and got up to 50 p.ct. with a reduction in the calorific value of only 20 B.Th.U. The calorific value of the carburetted hydrogen itself, after being scrubbed and washed, was about 330. This, again, proves that there is a great deal in the after treatment of this carburetted hydrogen gas immediately it leaves the generator. It is probable that the carburetted hydrogen conserves some of the hydrocarbons in the coal gas. In any case it is an important and interesting point. I believe there are possibilities in plants for the complete gasification of coal which will ultimately make them the salvation of small country gas-works.

Our results for this year are rather interesting, viz.: Make per ton of mixed gas, 16,848 c.ft. of 425 B.Th.U. gross = 7,159,600 B.Th.U. per ton of coal. Coke sold, 7½ cwt.; tar, 10·6 gallons; ammoniacal liquor, 42·8 gallons. The year when I took charge we made 10,324 c.ft. per ton; coke sold, 7·08 cwt; tar, 9·5 gallons; liquor, 20·7 gallons. I give these figures to show that high coke returns have not been possible at Newark, owing to direct-fired furnaces and a few very inefficient regenerators. Also we have not a very efficient scrubbing plant.

These results are not startling, and many works are doing very much better; but our trouble has been due to the retort-house. We have had no alternative but to work our retorts with about 9-cwt. charges of twelve hours' duration. A 9-cwt. charge is very nearly a full retort in our case; but to get a larger throughput out of this bench simply resulted in an enormous waste, due to the hydraulic mains, take-offs, and foul mains being so small. In fact, the loss was so great in this retort-house after charging a few retorts as to disgust any gas engineer. We tried many methods of working, but found that the charging of a few retorts frequently to maintain a fairly constant stream, and letting them run twelve hours, was the best method of getting along for the time being.

A considerable amount of tar is also recovered from the carburetted hydrogen plant, while the ammonia figure has been doubled. I fully expect to make at least 20,000 to 23,000 c.ft. to the ton of 450 to 425 B.Th.U. gas, with probably much better residual figures, when we have a decent retort-bench. I have had analyses made on the crude carburetted hydrogen gas for ammonia; and the average is about 76 grains per 100 c.ft., which, taking into consideration the amount of gas produced per ton of coal, is considerably more than the amount usually contained in coal gas. The total sulphur compounds average 13·5 grains per 100 c.ft.; and there is no trace of cyanogen. This is an interesting point. As will readily be imagined, we were constantly testing for H_2S and sulphur compounds throughout the works when we were short of washing and purifying plant, and the average amount of H_2S in the crude coal gas was 800 to 1,000 grains per 100 c.ft.; other sulphur compounds, 40 to 50 grains. Last year the H_2S averaged about 500 grains in the crude mixed gas, and other sulphur compounds rarely exceeded 20 grains per 100 c.ft. This is a great relief to our purifying plant. Hydrocyanic acid averages 127 grains per 100 c.ft in the crude coal gas and 59 grains in the mixed gas at the inlet to the purifiers. The purifiers remove all trace, and the amount in the clean coal gas is *nil*. SO_2 averages about 8 grains per 100 c.ft. in the carburetted hydrogen gas, and about 6 grains in the mixed gas at the inlet of condensers. The amount in the clean mixed town gas is *nil*, which is important if we are to avoid corrosion in pipes and meters as far as possible. CO has averaged 15 to 16 p.ct. in the mixed gas. An average analysis of the carburetted hydrogen gas when making 65,000 c.ft. to the ton, using Langwith coal, is as follows: CO_2 4·9 p.ct.; O 0·4 p.ct.; CO 28·4 p.ct.; C_nH_m 1·3 p.ct.; CH_4 5·55 p.ct.; H 50·7 p.ct.; N 8·75 p.ct.

The inerts are 14 p.ct.; but these can easily be reduced by steaming less and being content with a smaller make. We were steaming at 95 lbs. steam pressure. The calorific value of the gas was 335 B.Th.U., which gives a multiple of 21,775,000. Nitrogen was also estimated by the direct method to check these results. By working the plant in a different manner, the percentage of methane can be increased considerably; and I know of at least one works obtaining about 14 p.ct. of methane.

The tar recovered is simply mixed with the coal-gas tar at present. We partially distil the bulk of our own tar in a dehydrating plant, and have experienced no difficulty with the mixed tar.

The distillation of the water-gas tar gives the following fractions:

(Sp. gr. of tar, 1·05)

Water	8·0 p.ct.		
Oils up to 245° C.	3·0 ,,	Sp. gr.,	·915
Oils above 245° C.	36·6 ,,	,,	·98
Pitch	53·85 ,,	By weight.	

The tar is rather peculiar. It assumes a more or less solid form on cooling (something like vaseline), and during distillation no traces of naphthalene or anthracene can be observed, and practically no traces of H_2S. I have never seen anything quite like the oil above 245° C.; but it resembles blast-furnace oil more than anything; it would probably make an excellent gas oil. The most interesting point, perhaps, is the manufacturing cost:

	December, 1919.		*December*, 1920.	
	s. d.		s. d.	
Coal	2 10·73	per 1000 c.ft.	2 5·81	
Less residuals	1 2·37		1 4·68	
Cost of coal, less residuals	1 8·36	do.	1 1·19	
Purifying	0 0·22		0 0·34	
Carbonizing	0 4·92		0 6·38	
Supervision	0 0·36		0 0·51	
R. & M. works	0 9·89		0 9·78	
	2 11·75	cost of gas into holders.	2 6·2	Cost of mixed gas into holders.

The average price of coal has increased 4s. a ton during the year 1920, and wages have increased about 17 p.ct.

I noticed in the report of the Board of Trade inquiry on the Limitation of Inerts, that the Railway Company had analyzed Newark gas with many others, and the question was asked if a high inert content was unavoidable when using a complete gasification plant. The inerts can easily be regulated to 12 p.ct. if desired; but in our case it has been necessary during the period of heaviest consumption to force the plant by over-steaming, with a resultant increase in CO_2. To maintain a small percentage of other inerts with these plants, it is simply a matter of keeping valves tight. Our inerts quoted in the above analysis are 24 p.ct., and were mostly due to the coal-gas plant, and the method we adopted in working it. The figure was considerably more than 24 p.ct. before working the carburetted hydrogen plants, often 34 to 40 p.ct. It was also stated in this report that Newark gas, after compression, had a calorific value of 370 B.Th.U. Before compressing, the calculated calorific value from analyses was 422 B.Th.U. I am not clear to what extent the gas was compressed; but we have made analyses of the mixed gas before and after compression to 50 and 100 lbs. per sq. inch; and the analyses are practically the same in each case. We have not carried these investigations very far; but at the moment I am inclined to think the mixed gas will stand as much compression as most others.

A 425 B.Th.U. mixed gas—*i.e.*, a good quality coal gas diluted with carburetted hydrogen gas or water gas—is a totally different gas from a 425 B.Th.U. stretched coal gas. In fact, the calorific value is very little indication of its value in comparing the two from a practical point of view. It might be more economical, if coal remains at a high figure, and coke is a drug on the market, to manufacture a high-grade low-temperature coal gas and use the half-carbonized coke in the carburetted hydrogen plant. There are all kinds of possibilities; and our position is perhaps rather unique—we have been more or less forced into our present practice through our inability to obtain capital. Probably if we could have obtained plenty of money cheaply, we should have carried on on the usual orthodox lines with a more or less expensive retort-house, &c.

It is certainly a great advantage to have these carburetted hydrogen plants in several and varying units, as then practically the whole of this gas can be passed direct into the coal-gas stream from the particular unit that will make at its best efficiency the amount one wishes to use. I used to think the larger a water-gas set the better, as one man made more in a large set than a small one; but this to some extent has been equalized by arranging two smaller units, so that one man can operate both.

It has been a very interesting, if trying, experience at Newark during the last three years. I have been fortunate in having a Board of Directors who have sympathized with my difficulties, and latterly, a splendid staff. The general public and the Town Council, having had the position explained to them, have been very patient, and have not unduly harassed us. We make a special effort to give good service; and this has been appreciated. We are in the happy position so far of doing all the work I have mentioned without increasing our capital per million. The figure at present is £517. It was £570 when I started; so that, all

things considered, we have made, I think, the best of a bad job in a fairly satisfactory way.

DISCUSSION.

Mr. W. W. TOWNSEND (Colchester) said he should like to congratulate the author upon the initiative and enterprise he had displayed, and the many signs of originality, in his work, and the success he had achieved in overcoming his difficulties. The whole paper showed that he was the man for this particular job. The paper in a way was a commentary on the President's address. They were not allowed to discuss the address; but the President advocated a good many things which they all would very much like to do, but were not able to do. Any aspiring gas manager who read the paper and their President's address would see it was not quite so simple a matter to manage a gas-works in these days as it might appear to be by simply passing an examination in gas engineering. One might have made up his mind that vertical retorts were the right things; but when one got to a new place, he might find there was no room for such a plant, and no capital available for the purpose. This was the kind of difficulty with which Mr. West had had to deal. Even up to the present, he had not been able to put in new carbonizing plant he considered necessary. But he had managed to cope with a large increase in output, and to maintain the supply all these years. He would like to congratulate him upon the scientific and chemical control he had in operation. Very few works of the size of those at Newark were in a position to supply the amount of information contained in this paper. The author had given the fullest information, together with analyses of the gas in every possible way. The amount of the impurities—cyanogen included—was a thing that was very seldom given; but it was very interesting to know that, although he had a considerable amount of cyanogen in the gas, it was all removed by the purifiers. He (Mr. Townsend) had several questions to ask—not in the shape of criticizing the paper, but in order to elicit information. The first thing he noticed in the paper was that, in order to maintain the supply of gas, Mr. West considered it necessary to stretch the coal gas with inert gases. This appeared in the early part of the paper. It very frequently happened that there was a short supply; but he (Mr. Townsend) had never yet been able to understand what was the good effect of drawing in inerts. It did not appear to him to enable one to get more B.Th.U. by stretching the make and reducing to (say) 425 B.Th.U. than by sending out the original coal gas of the higher quality. Another point was that Mr. West mentioned the Venturi meter. They had had very little information about this type of station meter; and if the author could give the members further particulars in regard to it they would be valuable. It was also very interesting to hear of Mr. West's satisfactory experience in dealing with naphthalene. He noticed he referred in the first part of his description of the new apparatus he had installed to the paraffin dripping into a small annular tube; but later on he stated that he used 4 gallons of benzole per million cubic feet, and then gradually reduced to 1 gallon as the complaints got less. He (Mr. Townsend) would like to know whether it was paraffin or benzole that Mr. West used, because, if he had obtained such satisfactory results by injecting benzole into the gas, it was contrary to general experience. Benzole was used many years ago for this purpose. It was, however, found unsatisfactory; and an oil with a higher boiling-point, such as paraffin, was generally adopted at the present day. Then Mr. West had rather an interesting way of working his carburetted hydrogen plant. It would be of interest to know why he had no means of measuring the gas made in the Tully plant; and he would also like to have information as to how the plant was worked, because the author appeared to make a great point of putting hot water gas into the foul main. He also referred to a relief holder, so he (Mr. Townsend) presumed he worked from the generator partly into the foul main, and part of the gas went to the relief holder. In the latter case it had to come back more or less cool, and so they could only have the benefit of the hot gas in the foul main for part of the day. He took it that Mr. West proposed to work the two plants at one part of the day, and only one plant at the other part. The usual plan was to make as much water gas as they could in an eight-hour shift to fill up the relief holder, and then take the gas out of the relief holder during the remaining sixteen hours. But if they did this, they could not have the benefit of the hot gas going into the foul main. They could only have it while the plant was being worked. He should also like to point out that the author alluded to the foul main in the retort-house as not being large enough, yet he appeared to overload it by putting water gas in mixed with the coal gas. One would have thought this would have put a lot of work on that part of the plant. He should also like to know what kind of coal was used in the Tully plant. Was it gas or steam coal? Then with regard to the results, he saw that Mr. West claimed 16,848 c.ft. of gas, and sold 7½ cwt. of coke. Was the make of gas on all the coal used, including that gasified in the Tully plant? If this was the case, then the figure as to coke sold seemed to be very high. Of course, there was no coke from the coal used in the Tully plant; so that all the 7½ cwt. must come from the retort-house. If, therefore, Mr. West was using an equal percentage of coal and water gas, the coke sold would come to about 15 cwt. per ton on the coal used in the carbonizing plant alone. It would be rather interesting if this point could be cleared up. Then, further, was the tar taken on the whole of the coal used in both plants? He was pleased to find that they had obtained in this paper more information as to the residuals obtained from total gasification plants. It was interesting to know that the author got a considerable amount of tar from the Tully plant, as well as a considerable amount of ammonia. It would be interesting to know whether a lot of the ammonia was not lost in the circulating water; and from the gas which went into the relief holder one might expect that the ammonia would be thrown down there where they did not want it. He was very much obliged to Mr. West for having given them such full information.

Mr. H. G. RUGGLES (Leighton Buzzard), having congratulated Mr. West on the paper, said there were one or two points upon which he should like information. The first one was when he said that he changed-over his purifiers from the ordinary system to the backward rotation system. Could he give them any figure as to the greater benefit that he obtained—that was to say the extra amount of gas he was able to pass through his purifiers before changing, after he had made the alteration. With regard to a laboratory, at Leighton Buzzard they started one a couple of years ago, and he could certainly endorse the remarks of the author as to the benefit they derived from it. Mr. Townsend had remarked upon the excellent results obtained in respect of naphthalene. They had put down a similar apparatus at Leighton Buzzard; but it was one they made themselves. They worked with paraffin, and ran the compressor at 25 lbs. to the square inch. He also used a double tube made from wrought-iron pipe. They had one on each of their two trunk mains, and they answered very satisfactorily indeed. The point as to the passing of the carburetted hydrogen gas into the foul main had been touched upon by Mr. Townsend. How was Mr. West able to measure the quantity of the gas if it was passed in at a high temperature? It was a matter of impossibility, unless careful corrections were made for temperature, to know what was being got out of the carburetted hydrogen plant. The device Mr. West had put on his carburetted hydrogen plant for checking the runs and blows was very ingenious. The author stated that "it is a point of interest that we gain anything from 80 to 100 B.Th.U. by passing the hot carburetted hydrogen gas direct into the coal-gas foul main." This was no doubt due to the fact that the carburetted hydrogen conserved some of the hydrocarbons in the coal gas. In his own case they passed blue water gas into the foul main, but they did not get such a high result as that. The author did not give the costs of the plant, but this was perhaps rather a difficult thing to do in these days.

Mr. T. F. CANNING (Southend) said Mr. West was to be congratulated on the courage he had shown in coming forward, and speaking so openly of the difficulties with which he had had to contend at Newark. One feature of the paper struck him as being rather a suggestion to himself. That was the difficulty the author had experienced in regard to the design of the ironwork of his horizontal benches. In this matter, he (Mr. Canning) had had similar experience at Southend. It was rather surprising to his mind that after the years of accumulated experience in the design of the ironwork for horizontal benches, there should be such plants in existence to-day. Nevertheless, there were. And if it was any satisfaction to Mr. West to know this, he certainly had his very sincere sympathy as a fellow-sufferer. At Southend, he had had to deal with a system of ironwork in the horizontal benches that he thought he could claim was nearly as bad as that at Newark. In his case, the ascension-pipe, passing through the bottom of the hydraulic main, extended for a distance of several feet above the top of the main, and over the end of this pipe was threaded what one might describe as a thimble or sleeve which dipped into the liquor of the hydraulic main forming the seal. The gas, in passing away from this system, was wire-drawn into the annular space between the hot ascension-pipe and the thimble, with the result that the main was gradually brought to a condition in which it was impossible to work. He had had to alter the whole arrangement back to the ordinary bridge and dip-pipe now in general use throughout the industry. The work was partly finished; and the remainder would be done in due course. This system of ironwork had been a very great source of difficulty with him in coping with the largely increased consumption they had had at Southend; and his circumstances were more or less similar to those at Newark. The output from this plant had been reduced by about 50 p.ct.; and they had had a very heavy increase amounting to something like 63 p.ct. in consumption placed on the plant that was in this very inefficient condition. To cope with this largely increased consumption at Southend, he considered, in the same manner as Mr. West, the question of extending the coal-gas plant. His difficulty in this respect was very great, because he had restricted holder capacity. The storage capacity amounted to only 1¼ million cubic feet in two units—one holder of a million cubic feet, and one of a quarter of a million cubic feet. The smaller holder was used as a reservoir to draw from for the high-pressure system; and the million holder was used for general purposes on the low-pressure system. After going into the question of extending the coal-gas system, which would have entailed a new gasholder, and have taken two years to carry out, they fell back on a water-gas scheme; and it was decided to install a 1¼ million cubic feet plant and remodel two existing plants of ½ million cubic feet each. These two plants had to be run together to give sufficient gas, as they were short of steaming capacity. As to the very interesting point in Mr. West's remarks about the question of the size of the water-gas units, he (Mr. Canning) thought it was generally admitted that it all depended upon local and internal circumstances. Mr. West had certain circumstances with which to deal at Newark; he (Mr. Canning) had different ones at Southend. One of the striking advantages he had found with large units of water-gas plant was where they had limited holder capacity. Before the installation of the new plant at Southend, they had an output of no less than 2½ millions on Christmas Eve of 1919; and they were left at eleven o'clock on that evening with only 80,000 c.ft. of gas in the big holder, although the pressures were generally reduced. On the following Christmas Eve, after the 1¼ million plant had been installed, and one of the ½ million plants had been remodelled (increasing its capacity to over 900,000 c.ft. per day), with an output of close upon 2½ millions, they gained in stock in the large holder by no less than 102,000 c.ft. Where they had circumstances such as he had, it was absolutely imperative that one should have large units of water-gas plant. Of course, if times had been normal, they would probably have extended on the ordinary lines of coal gas, or some similar system, with a new holder, and what one might call orthodox procedure. Capital also entered into the question; and they knew what this meant at the present time, to say nothing of the cost of materials and labour. There was another point to which he should like to refer. That was as to the effect of using large volumes of water gas (lightly carburetted water gas he was speaking of), where they had restricted holder capacity. In this direction, he had found no difficulty whatever. With a mixture of 40 to 45 p.ct. of water gas, he had noticed a marked decrease in the number of complaints. As the proportion had risen to 50 p.ct. and over, the complaints on the district had almost reached vanishing point. This had been his experience at Southend. It might be due to their peculiar conditions there with regard to the plant; and he merely gave this piece of evidence to the members for what it was worth. There was another

question. Where they were filling and emptying a holder with the inlet and the outlet pipes side by side (as theirs were) they would expect that the number of complaints might increase owing to the gas going almost direct to the district. He had not found this. On the contrary, he had found a decrease. Furthermore, the recording calorimeter fixed on the district, with a mixture of 40 to 50 p.ct. and over of lightly carburetted water gas, showed practically a straight line, or what was virtually a straight line, on the chart. He was gratified to note Mr. West's remarks with regard to capital, because undoubtedly this was naturally an essential of good management. At Southend, the gas-producing capacity of the works had been increased since 1918 from 2 to 3½ million c.ft.; and the purifying capacity from 2 to 3 millions per diem. The capital per million sold in the pre-war year of 1913 was £1033, with an output of 420 millions; the capital per million cubic feet sold in 1920 was £748, with an output of 660 millions.

Mr. R. WALKER (Cheadle) said there was one point which mystified him. Mr. West made reference to 34 to 40 p.ct. of inerts being drawn into the gas in the awful retort-house of his. Were these inerts deliberately introduced into the gas? Mr. West had emphasized that his foul main system was not of proper capacity; and he (Mr. Walker) did not see how he could have drawn the inerts in either through the retorts or else through the joints between the lids and mouthpieces. He imagined that the inerts must have been drawn in somewhere on the foul main outlet.

The PRESIDENT, in closing the discussion, said he noticed that Mr. West had put in steam-turbines for his new plant. He wondered why he did not use a gas-engine. He was afraid gas managers, as a rule, went automatically to steam for power when they ought to go to gas. With regard to inerts, he did not think that 30 to 40 p.ct. was much more than probably many were sending out at the time of which Mr. West was speaking, though they did not like turning-out gas containing such a high percentage. What mystified him (the President) was that Mr. West had been able to send out gas of 400 B.Th.U. with in it such a high percentage of inerts. If they were going to keep their B.Th.U. down, they must also keep down the inerts. Mr. West had touched on the Venturi meter. Those of the members who had been to his Company's works that morning had seen one of these meters. He (the President) had had it at work for something like seven years; and he could speak very highly of the results obtained with it. He considered it to be quite equal to a meter of the ordinary type. It cost the Company something less than £300; while an ordinary meter of similar capacity at the time would have cost them something like £800. He had had it enlarged up to 1¼ million cubic feet capacity per day. They had had occasional visits from the representatives of Messrs. George Kent, the manufacturers of the meter; but there had been no real bother with it. It also had the good point that it did not take up much room. He should like to ask Mr. West a question in regard to the tar from the Tully plant. From the little experience he had had with it, it seemed to be pitch. He should like to know whether or not Mr. West could pump it. As to clinkering, he was glad to hear Mr. West say it was a very light matter, because their experience at Grays was that it was absolutely the reverse. But still they hoped for better things after hearing the paper. There had been some mention of the effect of compressing gas in reducing calorific power. At Grays, they compressed about one-third of the gas sent out; and his experience was that gas, collected something like twenty miles away, was reduced in value about 6 p.ct. Probably something was lost in travel as well as by compression. He did not, however, think it a matter of great importance, excepting that they were only allowed a margin of 5 p.ct.; so that they might have to work at a little higher figure in order to get the requisite B.Th.U. in the gas at the other end of the district.

Mr. WEST, replying to the discussion, thanked the members for the kind way they had received his paper, and the nice remarks that had been made concerning it. The question had been asked as to why the gas was stretched to the extent it was. It was necessary to draw in a fairly large proportion of air to keep the purifiers clean, as they were very small for the make. The foul mains were too small, and the retort-house governors fixed at the retort-house end, about 180 ft. away from the beds at work. This resulted in the beds nearest the governors being unsealed while the beds farthest away had a comparatively heavy seal. The foul mains on the outlet of the retort-house governors were three times the area of the foul main on the retort-bench, and the carburetted hydrogen gas was admitted at this point, and therefore was not throwing extra work on the section that caused their difficulties. The method of working the carburetted hydrogen plant was this: Both plants fed into a common main which was connected at one end to the relief holder, and at the other end to the coal-gas foul main, with a regulating valve. The idea of having small units or varying size carburetted hydrogen plants was to take the full output of the plant direct into the foul main if possible to prevent the losses which occurred by passing much of the gas into the relief holder. The holder simply acted as a compensator. The type of coal used was preferably a non-coking steam or house coal, high in fixed carbon, and low in ash. The tar could be handled quite easily by an ordinary pump when hot; but it assumed a more or less solid form when cold. The ammonia losses were perhaps considerable in the gas that went to the relief holder, but the idea was to pass as much as possible through the ordinary coal-gas scrubbers. They originally fixed a meter on the outlet of the relief holder to measure the water-gas, but did not use this now. Steam-turbines were decided on, as the direct-coupled gas-engine sets were not sufficiently developed when the original plant was erected. By mixing the gases regularly in the foul main, there was no difficulty with the water gas and coal gas stratifying. The purifiers were changed about once a week before adopting the rotation system. They now emptied the boxes once in three months to nine to twelve months with the larger boxes. Regarding naphthalene troubles, they had obtained practically as good results with benzole as with paraffin. As to the Venturi meter, the makers were in a position to guarantee it within a very close range of the ordinary station meter, and the repairs and maintenance bill would be quite small compared to the ordinary type.

The discussion then closed.

PEAT RESOURCES OF IRELAND.

AMONG the matters referred to the Fuel Research Board of the Department of Scientific and Industrial Research, was the question of the utilization of peat deposits in Ireland, which was subsequently made the subject of inquiry by a Committee specially appointed for the purpose. The Committee were asked to suggest what means should be taken to ascertain the conditions under which, in the most favourably situated localities, peat can be profitably won, prepared, and used, having regard to the economic position of Ireland. On the Committee reporting, the Fuel Research Board recommended the erection and maintenance of an experimental peat station on a selected bog area, provided an agricultural colony could be established on the area, under the control of the Irish Department of Agriculture and Technical Instruction. The proposal to form such a colony proved, however, to be not feasible. The reports and other documents relating to the matter have now been published for the Department of Scientific and Industrial Research by H.M. Stationery Office [price 3s. net].

The Committee state in their report that they consider the total content of all the Irish bogs is between 3000 and 3500 million tons of anhydrous peat, or (say) 4000 million tons of air-dried peat. At the present rate of peat consumption, which is about 6 million tons per annum, and supposing that all the imported coal (4,650,000 tons) were replaced by peat fuel on the basis of 2 tons of air-dried peat to a ton of coal, the peat deposits would satisfy the fuel and power requirements of the country for more than 250 years. In addition to the quantity of coal imported into Ireland, as just mentioned, there was, during the three years 1912 to 1914, an average of 88,000 tons per annum of native coal mined and used. After deducting the quantity of coal burned on railways, the balance left for domestic, gas-producing, and manufacturing purposes is 4,263,000 tons; and of this, during the period 1912 to 1914 inclusive, an average of 376,000 tons per annum were used for the manufacture of gas, and 178,000 tons of coke were produced. The total quantity of coal consumed in Ireland for all purposes amounts only to 1·08 tons per head per annum, besides which a considerable bulk of peat is used. This, the Committee point out, must be taken into account when making a comparison with the corresponding figure for the United Kingdom, which was 3·97 tons per head for the years 1912 to 1914.

The Committee discuss the methods adopted for the winning of peat fuel in Ireland, and new ways by which the output can be increased. In the matter of price, they say the coal used for industrial purposes in Dublin may be taken as costing on a fair average 15s. per ton during the three years already referred to. Since then the trend of coal prices has been steadily upwards; and it does not seem likely to them that prices will undergo any material reduction for many years. But even assuming coal at 15s. per ton, and accepting what they regard as the conservative calorific equivalent of 2 tons of peat to a ton of coal, the competing price of peat fuel is fixed at 7s. 6d. per ton at the same place, no account being taken of the value of the bye-products. From the results of the Committee's investigations, they are of opinion that peat fuel can be won in Ireland in large quantities and delivered at a central power station within (say) three miles of the bog site at a price per ton, including all charges, below this figure.

Masonic.—As already intimated in our pages, the next meeting of the Evening Star Lodge, No. 1719, will be on Monday, the 23rd inst., and will coincide with the meeting of the Institution of Gas Engineers. As in former years, the lodge will welcome all masons who are members of the Institution; and those desirous of attending are requested to communicate with Mr. Rae P. Normand [No. 21, John Street, Adelphi, W.C.], who will send the necessary dinner cards. Those who have not previously attended the lodge should forward the names of two brethren who will vouch for them. This notice takes the place of the circular-letter that it has been usual to send to members of the Institution in former years.

The "F.B.I." and Fuel Economy.—The completion of eighteen months' active existence of the Fuel Economy Committee of the Federation of British Industries, and of six months' practical work by the Technical Sub-Committee (with Prof. W. A. Bone as Chairman), have been marked by the publication of a "Fuel Economy Review," with the co-operation of well-known authorities in the different branches. An account is given of the work of the Fuel Economy Department of the Federation, and of the lines upon which investigation is carried out on behalf of those manufacturers who apply for advice and help. There are also to be found a summary of a memorandum on "Boiler Efficiency" prepared by the Technical Sub-Committee, and a report as to the result of the coal and coke *questionnaire* issued last year by the Federation. It is felt that the figures obtained through this inquiry provide interesting information to the student of possible fuel economy. The results indicate a very marked increase in recent years in the amount of raw coal used in the gas industry, producer-plants, and coke-ovens. There are in the "Review" useful articles on the subject of fuel economy by Sir Robert Hadfield, Sir Dugald Clerk, Mr. David Wilson, Mr. J. S. Highfield, and Mr. P. R. Allen.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

A Lecture by Mr. John Terrace.

A good session's technical programme of the Association was fittingly brought to a conclusion last Friday night by Mr. John Terrace, the Engineer to the South Suburban Gas Company, who delivered a lecture, entitled "A Man's Work," to a large number of members at the Westminster Technical Institute.

Really, the lecture was divided into two parts, in the first of which Mr. Terrace set himself the task, which he successfully accomplished, of suggesting some lines of thought, to show his hearers how to work intelligently, and with purpose. In considering his subject, he took a wide meaning of the word "work," so that it covered more than the period normally spent in the works, at the desk, in the laboratory, show-room, &c. Success, he said, depends upon opportunity; and it is a great thing to be prepared to grasp the opportunity when it comes. How can one be so prepared? First of all by work—very often hard work, and plenty of it—and, as the greater part of each twenty-four hours is mostly spent in work, it is well so to choose and regulate the work that it becomes a pleasure. A word of warning was uttered against allowing one's daily routine work to become merely mechanical. To do one's work efficiently and expeditiously is the first step towards something higher; and while there is a great deal of satisfaction to be obtained from having carried out a day's work honestly and well, it is fatal to advancement to allow one's energies to stop there. The importance was emphasized of wide and well-selected reading, and of classifying the information obtained. In addition to the study of technical subjects, it is essential to the formation of character that a fair amount of general reading should be done. Character and personality, said Mr. Terrace, are probably the greatest assets of any man; and without them knowledge may be of little use. Character is not formed in a day; and the noblest character is the one with the best thoughts. Try, therefore, to keep your thoughts pure, and your actions above reproach, and good must inevitably follow. While your character is greatly formed by your thoughts and mental culture, it is licked into shape by your dealing with your brother man. Get in touch with him, and consider from his view-point as well as your own. Remember there are two sides to most questions, and there may be partial truth in each. If a man is just, upright, and true, he has a sure foundation on which to build his life's work; and as his work reacts on his character, the quality and method of his work are important, and work itself is indispensable. No man can do anything worth while on theory.

Mr. Terrace possesses strong and sound views on the subject of education; and in giving expression to them, he complimented the Association upon the active part they had taken in the recent negotiations on the question of examinations as a qualification for membership of different Institutions. The future efficiency of our workmen, and the prosperity of our country, he declared, depend greatly upon education. Fortunately, most employers see that it is to their own interest to give their employees assistance in this direction; and many have arranged to build on the foundation which the primary education provides, by having classes on technical subjects affecting their business held during what are commonly termed working hours—which means at a time when the youth is not, as often used to be the case, too tired to benefit by the tuition provided. The lecturer does not think that at the present time sufficient attention is given by those in authority to the subject of education, though some few undertakings now provide a proper apprenticeship for certain branches, principally gas fitting and the engineering trade; but systematic training for those employed in the essential processes of gas manufacture and purification is practically unknown. In these branches, particularly the junior members of staffs may prove very helpful by preparing and discussing schemes whereby these omissions may be made good. The time is now ripe. Employers are anxious, as they have never been before, to confer with those who have constructive schemes ready for discussion; but unfortunately a great deal of the talk of the betterment of working conditions is destructive rather than constructive. The heads of undertakings to-day have so many calls on their time by matters relating to ordinary routine and the development of business, that they would, or should, welcome any suggestions from those who are in daily contact with the details of manufacture and distribution. Much can still be done by providing suitable education and training for those workmen who desire to profit by it. One cannot drill men to proficiency; and unless they are willing to make the necessary effort, any amount of opportunity is of little avail. The old idea of Crafts and Guilds needs reviving in a modified form—each undertaking receiving as many as possible of its future employees direct from school, completing their education, and then deriving the benefit of their services.

Referring to the present labour unrest, the lecturer said the time is ripe for giving every man an opportunity of taking his share in the control of the business in which he is engaged. The unfortunate feeling of distrust must be removed, and each man given as much responsibility as he is able to take. His energies and thoughts must be guided towards constructive work. Mr. Terrace has had full experience of the benefits of co-partnership, the institution of which he recognizes as the first real step towards the solution of the labour trouble. True co-partnership, he said, means that a workman must have a voice in the management and control of the business in which he is engaged; and he bore testimony to the success of the employee director. He also explained the operation of the Works Committee in the South Suburban Company; this Committee having proved very successful in investigating cases of complaint, &c., the discussion of which would be out of place in the Board Room. Allusion was also made to the method in practice of inquiring into accidents by a jury of workmen, over which Mr. Terrace presides. He testified to the intelligent and efficient manner in which the juries carry out these inquiries.

Works Organization and Control.

Coming to the second portion of his lecture, Mr. Terrace remarked that one of the greatest aids to successful control is to be able to put one's hands quickly on necessary information; and for this a good filing system is indispensable. He proceeded to describe the one which, after extended trial, he has found most applicable to his own requirements. This was suggested to him by Mr. Pearson, one of the Directors of the Library Bureau. The information to be filed is marked with a particular letter, which designates its position in the file; and this letter is also immediately conveyed to one's mind by the nature of the information. Suitable folders, legal size, are used; and the papers are accommodated in a vertical file. A lantern-slide gave particulars of the guide employed. Along the top are the letters of the alphabet, and again down the side. Those along the top are used for the main subjects, and those down the side for the subdivisions of these subjects. For example, the letter B is used for "Bye-Products of Gas Manufacture," and is subdivided into A for "Ammonia," (which would naturally include ammoniacal liquor, concentrated ammonia, and sulphate), B for "Breeze," C for "Coke," L for "Lime," O for "Oxide," P for "Pan Ash," S for "Sales Contracts," T for "Tar," X for "Benzole and Toluol," and Y for "Cyanides." Guide-cards show the main subjects on the left-hand tab by name—thus, "Bye-Products"—and the subdivisions on the right-hand tab by letter, as B A for "Ammonia"; while the folder is provided with a tab on which particulars of its contents can be entered. Specimens were available for examination at the meeting.

The next two slides shown had reference to methods which have been found useful for indicating the relationship of the various sized mains on a district. The first slide was a photograph of a model (which was also on view, and closely inspected by the audience after the lecture) of the gas-mains in the Tottenham district, for the loan of which Mr. Terrace expressed his indebtedness to his late chief, Mr. A. E. Broadberry. In this model, the various sized mains are shown by wire of different gauges superimposed on a map of the district; and as the gauge of the wire is proportional to the diameter of the main, the relative delivering capacities of the mains are clearly indicated. The second method illustrated was the one applied to the district of the South Suburban Gas Company; and in it different colours are used to designate the various diameters of the mains. As, however, a multiplicity of colours would be a confusion, one colour is used for a group of mains—all pipes over 12-in. diameter being indicated by a thick black line, 12-in. pipes by red, 10-in. by green, 8-in. by blue, and 6-in. and under by yellow. It would, he said, be an advantage to use a different colour for 3-in. pipes, leaving the yellow for 4-in. and 6-in. pipes. The high-pressure pumping-pipes connecting the various stations are shown in thick black dot-and-dash lines.

Another interesting and suggestive model on view illustrated the distribution of the gas-lamps in part of the Tottenham Company's district. Each lamp is shown by a pin with a large head; and various colours may be used to indicate the description of lamp. The district of each lamplighter can also be readily indicated by a piece of coloured wool passed round the lamps he has to attend.

Several simple and novel indicators which he had seen when on a recent visit to the Tottenham works were then illustrated and described by Mr. Terrace, who paid a tribute to Mr. Broadberry's willingness at all times to place his ideas at the service of others in the industry. One of these was a diagram which hangs in the machinery room, for the purpose of indicating by moveable discs hung in different positions under various headings the portions of the plant at work, the parts idle, where repairs are being carried out, and where they are necessary. Another effective and simple diagram was for keeping track of the Company's coal and coke wagons. The wagon numbers are shown along the top, and the dates down the side; cross ruling dividing the diagram into a series of small squares. The time that the wagon is on its way to the colliery is shown in one colour, on its way back in another, and in the works in a third; so that any serious delay is at once detected. The horizontal space against Sundays forms a band of light red colour which effectively divides the time space into weeks. Where the number of wagons is large, the diagram is mounted on a board; and a T square with the wagon numbers marked on it facilitates reference.

At the conclusion of the lecture, the President (Mr. Frank J. Pearce, of the North Middlesex Gas Company) said they had had a great many good points put before them. He could most heartily endorse all that Mr. Terrace had said in favour of co-partnership. Having had considerable experience of a works

run with co-partnership and without it, he could say that he would not willingly be without it.

A hearty vote of thanks was accorded Mr. Terrace, on the proposition of Mr. F. A. Frost (South Metropolitan Gas Company), seconded by Mr. Kenshole (Lea Bridge District Gas Company). Mr. Frost remarked that the lecture had come at a very opportune time. There was no doubt that the future of the country was bound up with education—especially the education of the workman. They would all agree as to the effectiveness of co-partnership in dealing with industrial unrest; and if ever there was an industry to which co-partnership was applicable, he thought it was the coal-mining industry.

In reply, Mr. Terrace assured the members that it had been a pleasure to him to come along and give the lecture. He had always taken a great interest in the Junior Associations, and was only too glad to do what he could to help forward their work.

The Hon. Secretary (Mr. George Winslow) said it had been intended to make a presentation of books to two members; but this had had to be postponed, owing to new editions of the books selected being still in the printers' hands. The members who are to receive the books are Mr. D. W. Evans (Sales Department of the South Suburban Gas Company), silver medallist in "Gas Supply;" and Mr. E. C. Nash (South Metropolitan Gas Company), silver medallist in "Gas Engineering."

STENCHES FOR BLUE WATER GAS.

Technical Paper No. 267 of the United States Bureau of Mines deals with the above subject in an essay by Messrs. S. V. Katz and V. C. Allison.

The authors point out that loss of life and property frequently results from leakage of fuel and illuminating gases—especially the former. The non-enriched water-gas used for fuel purposes alone, and commonly called "blue water-gas," on account of the flame it produces, is especially dangerous, as it contains about one-third of its volume of carbon monoxide, and is almost inodorous. Certain German cities require such gas to be always supplied with a stench, to give warning of its escape in an unconsumed form. Natural gas has also little odour. Obviously, the stench chosen should be characteristic, essentially disagreeable, and capable of retaining itself in admixture with the gas through all the transportation that it undergoes.

Two dozen substances that seem applicable to this purpose have been investigated by the authors of the bulletin. Some of these are too expensive for large-scale use; others too liable to cause corrosion of pipes; others, again, not sufficiently disagreeable to serve as a warning. It must also be borne in mind that a very large number of persons have defective sense of smell, and marked odours may be present in their environment and not be detected by them.

Details are given in the bulletin of the methods of determining the value of the several stenches, and of the results of these determinations. Some stenches containing notable amounts of sulphur may be objectionable on account of the sulphur oxides that will be added to the air by the combustion of the gas containing them. Wide differences were observed in the efficiency of the substances examined. Amyl thioether ($C_5H_{11}S$) gave the highest odour with the smallest concentration—only 0·4 mg. per cubic foot being sufficient to give strong intensity. Judging by market price alone, the two cheapest stenches which impart a strong odour are amyl acetate and nitrobenzene; but both of these are unsatisfactory because the odours are not unpleasant to many persons. Ethyl hydrosulphide (ethyl mercaptan, C_2H_5HS) and pyridine seem to be the only other stenches with highly disagreeable odours which are quoted at prices that seem worthy to be considered for large-scale use. Pyridine is especially suitable; for although the pure article is quoted at $2·50 per gallon, an impure article, which serves as well, can be obtained from the acid washings of light oils. Phenyl isocyanide has an extremely disagreeable odour, and, though not listed as a commercial chemical, can be prepared by comparatively simple and inexpensive methods. Conservative figuring shows that gas can be probably satisfactorily impregnated with it at a cost of less than 1 c. per 1000 c.ft.

Cleaning-Out Tar-Separators.—Mr. O. W. Adams, in the "American Gas Association Monthly," tells of a plan adopted by the Brockton Gas Light Company for cleaning-out tar-separators. A basin was formed in the yard adjacent to the water-gas tar-separator, by throwing-up an embankment of coke breeze as a retainer for the sludge about to be deposited therein. The embankment also acts as a filter, allowing the water to seep through, while the heavy sludge, tar, and oil remain within. Compressed air is used through a ¾-in. hose attached to a pipe, the other end of which has a tee made-on at the branch outlet. The open end is circulated by the operator on the bottom of the separator between the several partitions and skimmers, thereby agitating, and putting in solution, the sludge, which is pumped out by a diaphragm pump. The suction line must be kept on the bottom, and moved from one end to the other under the skimmers and partitions as the pumping proceeds; the air agitation having been stopped to allow the sludge to precipitate and be drawn-out by the pump.

GAS POWER IN POTTERIES.

At a recent meeting in Hanley of the Stoke-on-Trent Association of Engineers, a paper was read by Mr. W. E. STEVENSON, of Birmingham, dealing with modern methods of power generation in potteries. The object of the paper was, apparently, to prove that of all prime movers, none would tend, under present prevailing conditions, to conserve the fuel resources of the nation to a greater degree than gas power.

The author gave comparative figures for the generation of power by means of (1) electrical supply direct from corporation mains, (2) steam-engines, and (3) gas-engines, working on town, suction, coke-oven, or blast-furnace gas. He said it was a very significant fact that, whereas an up-to-date large steam-turbine would not give a better thermal efficiency than 18·5 p.ct., the efficiency with a medium-sized internal combustion engine was 30 p.ct., after allowing for the recovery of the waste heat.

With a 50 H.P. gas-engine, charged with a constant working load of 30 B.H.P. for 47 hours per week—a reasonable load factor, and one that was fairly general in pottery factories—the net cost of working by town gas, after making all due allowance for interest, depreciation, and renewals on the capital outlay in connection with the necessary plant, would be not more than 1·53d. per B.H.P. The cost of working under identical conditions, but with electrical current from the corporation mains, would be 2·7d. per B.H.P.—showing a net saving of over £300 annually in favour of the gas power set. For a unit of this size, no case could be made out for working by steam; and even in those cases where steam was required for heating purposes, manufacturers were beginning to see that it paid much better to have a separate boiler for heating purposes alone. It was a notable fact that many steam-engine and boiler manufacturers in various parts of the country had already replaced their own steam-plant with gas power.

Where town gas was available at a reasonable price, it would be found advantageous to use this for engines up to 100 H.P.; but where the power required was in excess of 100 H.P., and this heavier load was continuous, it would be desirable to consider seriously the use of a producer-gas plant in conjunction with the engine. Assuming a constant load of 150 B.H.P. for the whole of a 47-hour week, the total cost of installing and running a double-cylinder, horizontal gas-engine of 180 B.H.P., complete with suction-gas plant, operated by anthracite coal, would be not more than 0·94d. per B.H.P. per hour, taken on a yearly estimate. Additional economies might be effected by means of a waste-heat boiler.

For installations of units of 450 B.H.P., it would be generally more satisfactory to generate the whole of the power electrically, and transmit it through motors. The final cost per unit by means of a three-crank, six-cylinder, vertical gas-engine, direct-coupled to suitable generators, and complete with suction-gas plant, would be not more than 0·86d. per unit. This estimate was based on an anthracite coal plant. Additional economies might, however, be effected by alternative plants suitable for use with bituminous fuel. In the latter case, the net cost per unit would be not more than 0·83d.; and if two or more units of this size were employed, consideration could be given to the recovery of the bye-products, which would bring down the net cost to 0·75d.

Finally, Mr. Stevenson gave calculations of the cost of running gas-engine plants of 1000 H.P. Bearing in mind the growing use of gas for firing purposes, he said, it would be to the advantage of the potter to consider the utilization of the same producers for the supply of gas for power requirements. Gas-fired boilers of the Bonecourt type would give an efficiency of 90 p.ct. in normal working practice, whereas the average steam-boiler would only give an efficiency of 20 to 25 p.ct. With regard to the larger-sized gas-engines, the prejudice which at one time existed was gradually being dispelled; and though it was not claimed that the large gas-engine of 5000 H.P. was now fool-proof, the manufacturer who decided to instal a reputable type could at least rely upon having in the gas-engine a prime mover which would yield as good results as any other that was available.

A lecture is to be given on "Fuel Efficiency" by Mr. E. W. L. Nicol, Engineer and Fuel Expert to the London Coke Committee, at a meeting of the Metropolitan Technical Section of the Local Government Officers' Association. Visitors are admitted to the meeting, which will be held at Caxton Hall, Westminster, next Tuesday, the 10th inst., at 8 o'clock.

The presentation of the first award of the Kelvin Medal will be made to-day, in the Hall of the Institution of Civil Engineers, to Dr. William Cawthorne Unwin, F.R.S. The medal was founded in 1914, principally by British and American Engineers, to commemorate the achievements of Lord Kelvin in those branches of science which are especially applicable to engineering. The award is dealt with by a Committee of the Presidents of the representative British Engineering Institutions, after their consideration of recommendations received from similar bodies in all parts of the world; and, in accordance with the terms of the trust, it is made to the person whom the Committee find to be most worthy to receive this recognition of pre-eminence in the branches of engineering with which Lord Kelvin's scientific work and researches were identified.

AN AMERICAN GAS PURIFICATION INVESTIGATION.

By W. A. DUNKLEY and C. E. BARNES.

(*Continued from p. 205.*)

RESULTS OBTAINED IN PLANTS INSPECTED.

As will be seen clearly in Tables I. and II., purifier capacity alone will not necessarily insure good purifying results. Some of the best results found in the Illinois plants at present are in overloaded plants. A study of Tables I. and II. shows how difficult or impossible it is to harmonize the results actually obtained with the conditions under which they were obtained. In general, one cannot but be impressed by the difference between the results shown and those generally considered as typical of the best practice. Text-books and treatises on gas manufacture usually state that spent oxide will contain from 50 to 60 p.ct. of sulphur, thereby implying that this degree of sulphiding is usually attained before the oxide is discarded. Yet the results shown in the tables indicate that, in the average Illinois plant at least, not nearly the usually accepted standard of performance is actually realized. In the water-gas plants, the average percentage of sulphur in the spent oxide was only 21·7 p.ct. In the mixed-gas plants, on the other hand, the average was 37·4 p.ct. These results are somewhat lower than those reported by Mr. Evans in the paper already referred to. The average absorption in the water-gas plants studied by him was 35 p.ct. sulphur and in the coal-gas plants 44 p.ct. The latter figure is, we understand, for straight coal gas, whereas the results reported by us in Table II. are for mixed-gas plants. It is probable, too, that the plants whose results are reported by Mr. Evans are considerably larger in size than the plants in Illinois inspected by us, and therefore the conditions were probably more favourable for good results. Even so, it is apparent that the results generally obtained fall considerably below those considered good standard practice.

In comparing Tables I. and II. one is impressed with the very considerable difference in sulphur absorption in the two gas-making processes. A number of reasons for the difference may be suggested. Coal gas usually contains considerably more sulphur per unit volume than does water gas; and according to the law of mass action, the greater concentration of the H_2S in coal gas increases the rate of absorption. The coal gas production is also more uniform and the peak-loads on the purifiers usually represent a greater rate of water gas purification rather than of coal gas, so the average load conditions with coal gas are more favourable. The ammonia in coal gas, of which traces pass through the purifiers, may also assist materially in the purifying process by keeping the oxide alkaline. A section of the Purification Committee of the American Gas Association is now studying the effect of this factor.

In the columns of Tables I. and II. marked "Total gas purified per bushel—1000 c.ft.," the assumption was made that the H_2S content of the gas was constant and the same as at the time of inspection. The figures reported are probably quite as accurate as the results reported in the purification records of most plants; but owing to the uncertainty of the assumption on which they are based, no claims to great accuracy are made for them.

Causes of Low Efficiencies.

The cause of the discrepancy between standard purification practice and the actual results observed in Illinois plants is a complex one. It is probably due to some extent to overload. That an overloaded condition of the purifying equipment can result in low sulphur absorption is evident from a consideration of the effect of overload on operation. Where the gas has to be passed through the boxes at an excessive rate, although the oxide may at first completely purify it, the condition where it cannot completely remove the sulphur is reached sooner than would be the case if the rate of gas flow were slower. The time between box changes will therefore be shorter with the faster rates.

The complete absorption of hydrogen sulphide requires a measurable time of contact between gas and oxide. When the material is fresh, a shorter time of contact seems adequate; but as the surface of the oxide becomes sulphided, a longer time of contact seems necessary for the complete absorption of the hydrogen sulphide by the inner particles of oxide. With very rapid rates of gas flow, the absorption seems to be at first largely superficial; and after the superficial capacity of the material has been utilized, longer contact seems to be necessary for complete absorption of H_2S.

The absorption of sulphur per change will therefore be less with an overloaded purifying system; and to get the same absorption, an oxide will have to be handled more times than would be necessary were the flow slower. Each time an oxide is handled it becomes finer from breakage, and with frequent handling the oxide soon becomes so fine as to favour packing and back-pressure. Conditions which lead to overloading the purifiers also usually favour overloading the other gas-cleaning equipment; so that more tar is likely to be carried into the boxes (other conditions being the same) when the purifiers are worked beyond their capacities. Therefore, more rapid tarring and excessive breakage of oxide in an overloaded plant are likely to result in depreciation and discard of the purifying material sooner than in a plant operated at normal capacity.

We note, however, that some of the overloaded plants excel other similar underloaded plants in absorption realized; so this does not appear to be the only or perhaps even the most serious cause.

Tar in the gas is also a contributory cause; but it is difficult to say in a particular case to just what extent efficiency was reduced by it, for some of the spent oxides collected that are high in tar are also high in sulphur. This would lead one to think offhand either that tar has little effect on sulphur absorption or that most of the sulphur absorption had taken place before the oxide was tarred. In order to determine roughly the effect of tar in the oxide upon efficiency of its absorption of hydrogen sulphide, an experiment was carried out, the results of which are shown in fig. 3. The

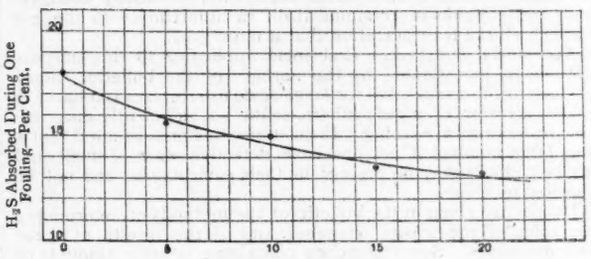

Fig. 3.—Effect of Tar on the Absorption Capacity of an Oxi Hydrogen Sulphide, First Fouling.

absorption capacity of a particular oxide for pure hydrogen sulphide was determined by the Kunberger method. Portions of the same oxide were then treated with various percentages of tar, and their absorption capacities after treatment were similarly determined. The tar was applied by making up by a solution of water-gas tar in pure carbon bisulphide. Each sample of oxide was treated with an amount of this tar solution corresponding to the required percentage of tar. The tar solution and oxide were thoroughly mixed; then the carbon bisulphide was removed by

TABLE I.—*Purifying Results Obtained in Water-Gas Plants Inspected.*

Plant.	Average Daily Production —1000 C.Ft.	Max. Make Hr.—per Cent. of Max. Purifier Capacity.	Bushels Oxide per 1000 C.Ft. Max. Hourly Production.	Kind of Oxide in Use.	Weight Spent Oxide—lbs. per Bushel.	Sulphur in Spent Oxide—P.Ct. Dry Basis.	Tar in Spent Oxide—P.Ct. Dry Basis.	Sulphur—lbs. per Bushel Dry Spent Oxide.	Tar—lbs. per Bushel Dry Spent Oxide.	Grs. H_2S per 100 C.Ft. Unpurified Gas.	Total Gas Purified per Bushel—1000 C.Ft. ‡	Method of Revivification.
1	1650	45·6	168	Rusted borings .	34·6	18 2	8·2	6·3	2·8	180	26·0	1 p.ct. air in gas and outside of box.
2	1400	277·0	40	Rusted borings .	44·1	12·0	3·4	5·3	2·4	100	88·5	Outside box only.
3	617	196·0	58	Natural	26·9	26·7	19·0*	7·2	5·1	190	26·6	1½ p.ct. air in gas and outside of box.
4	170	88·0	100	Rusted borings .	35·2	15·1	4·6	5·3	1·6	175	22 5	Outside of box only.
5	360	119·2	78	Rusted borings .	65·3	40·1†	2·0	26·2	1·3	130	..	2 p.ct. air in gas and outside of box.
6	1450	186·0	63	Rusted borings .	33·0	33·0	1·8	11·0	0·6	125	65·5	1 p.ct. air in gas and outside of box.
7	3880	136·0	61	Natural	50·5	21·2	8·7	10·7	4·4	100	106·0	1 p.ct. air in gas and outside of box.
8	3200	168·8	62	Natural	38·4	25·8	2·3	9·9	0·9	125	58·9	1½-2 p.ct. air in gas and outside of box.
Averages . .		145·8	79		41·0	21·7	6·9	7 9	2·5	140	49·3	

Indications are that this oxide was tarred badly after it had absorbed most of its sulphur content.

This plant was making straight water gas when inspected, but the spent oxide had been fouled chiefly by coal gas.

‡ The figures in this column are based upon the assumption that the H_2S content averaged the same throughout the life of the oxide as at time of inspection.

TABLE II.—*Purifying Results Obtained in Mixed-Gas Plants Inspected.*

Plant.	Average Daily Production —1000 C.Ft.	Make Max. Hr.—per Cent. of Max. Purifier Capacity.	Bushels Oxide per 1000 C.Ft. Max. Hourly Production.	Kind of Oxide in Use.	Weight Spent Oxide—Lbs. per Bushel.	Sulphur in Spent Oxide—per Cent. Dry Basis.	Tar in Spent Oxide—per Cent. Dry Basis.	Sulphur, Lbs. per Bushel Dry Spent Oxide.	Tar—Lbs. per Bushel Dry Spent Oxide.	Grs. H_2S per 100 C.Ft. Unpurified Gas.	Total Gas Purified per Bushel—1000 C.Ft.*	Method of Revivification.
5	360	119·2	78	Rusted borings	65·3	40·1	2·0	26·2	1·3	130	..	——
9	850	91·8	107	"Home-made" rusted borings	62·8	44·1	5·3	27·7	3·3	90	228	Outside of box only
10	600	245·0	38	Rusted borings	65·4	37·2	2·1	24·3	1·4	230	78	Outside of box only
11	200	39·4	246	Rusted borings	70·3	40·7	3·2	28·7	2·2	340	63	Outside of box only
12	550	111·5	71	"Home-made" rusted borings	71·0	32·5	6·0	23·1	4·3	220	78	Outside of box only
13	440	114·5	92	Rusted borings	58 9	30·2	1·7	17·8	1·0	150	88	Outside of box only
14	1500	73·0	153	"Home-made" rusted borings	67·2	41·4	4·8	29·8	3·2	165	134	Outside of box only
15	170	256·0	45	Rusted borings	50·0	21·4	4·4	10·7	2·2	350	23	Outside of box only
16	1400	34·0	351	"Home-made" rusted borings	75·0	36·4	2·6	27·3	2·0	480	42	In off box with air
Averages		120·6	138		65·1	37·4	3·6	24·0	2·3	239	91	

* The figures in this column are based upon the assumption that the H_2S content of the unpurified gas throughout the life of the oxide was the same as at time of inspection.

evaporation in the air. The tar was left deposited on the oxide, which was then subjected to the fouling test.

While the conditions of the test and the results obtained are not strictly comparable with practical conditions, they indicate something concerning the effect of tar in coating oxide and decreasing its absorption capacity. Of course, the ability of the material to revivify is also affected, so that tar is a disadvantageous thing to have present at any and all times.

It was thought at first that the reason for the comparatively high sulphur percentages in some rather tarry oxides might be due to the tar-extracting action of a portion of the oxide batch permitting the remainder of the batch to foul more completely on tar-free gas. It was expected that analyses of oxide from different levels in an upward-flow box would show a concentration of tar in the lower part of the box. Samples of oxide were therefore taken in two plants—one water-gas and the other coal-gas—at various levels. Each sample was collected from several points at the same level, to insure representative sampling. It is surprising to note that the tar is not concentrated at the bottom. In the water-gas plant, the greatest percentage of tar was found in the bottom of the upper layers; while in the coal-gas box the top of the batch contained the most tar. Likewise, there is no apparent relation between the percentages of tar and sulphur in these batches. The highest percentage of sulphur in each case is coincident neither with the lowest nor with the highest percentage of tar. One thus naturally concludes that each batch must have absorbed the larger part of its sulphur in each case before the tar was present to any great extent. The concentration of tar in the upper part of the batch may be caused by tar condensing out of the gas (due to the cooling action of the purifier box cover), and dropping down into the oxide. Of course, in practice the accumulation of tar is relatively slow; and since the rate of sulphur absorption in a given part of an oxide batch is slowing-down as the concentration of iron sulphide increases, it is difficult to determine in a particular case to just what extent the accumulation of tar is affecting the performance.

It is probably safe to say, in spite of the difficulty in demonstrating to a certainty, that tar interferes with purification efficiency more than any other single cause.

Methods of Revivification in Use.

Inspection of Tables I. and II. is likely to surprise advocates of revivification in place. It will be noted that whereas most of the straight water-gas plants introduce from 1 to 2 p.ct. of air into the gas prior to purification, the mixed-gas plants, with one exception, resort to the old method of revivifying oxide in the open air. Revivification in place has been in use for many years. Its theoretical advantages, especially under the now nearly universal heating-value standard, are almost unquestionable. Why then is it not more universally used? One coal-gas operator, when questioned in regard to the matter, stated that his retort-settings leaked, so that enough air was admitted. Whether the leakage was really air or furnace gases was not demonstrable by any tests made in his plant. Other operators stated that so light a seal was carried on the hydraulic main that air was drawn-in every time a retort was opened. While it is perhaps true that there is often considerable leakage of air or gas into the gas-system this is a most uncertain and doubtful way of revivifying in place, and possesses other disadvantages as well. When the retorts are leaky, it may be inadvisable for the time being to dilute the gas any further; but it would hardly seem reasonable that this uncertain method of introducing air is in vogue in a majority of the coal-gas plants. Other objections to revivification in place are frequently advanced, including the additional cost of enrichment to make up for the inert nitrogen introduced into the gas. Another objection frequently advanced is that the oxide has a tendency to cake very hard when revivification in place is tried. It is probably true that where an attempt is made completely to foul an oxide to its capacity with one handling, the caking will be pronounced; but it is believed that an attempt to carry revivification to this extreme is seldom practiced. Where caking has been found to occur with revivification in place, study should be given to the subject with a view to relieving this condition without abandoning revivification in place altogether. Some operators state that a lack of a proper amount of moisture in the gas is a fruitful cause of caking. An excessive loading of the material with iron, whereby the weight per bushel is greatly increased, might cause trouble, especially in deep beds of oxide. Under such conditions, consideration might well be given to the question whether the extra iron really pays for itself in amount of absorption obtained. It may be that a lighter oxide capable of revivifying rapidly might realize considerably greater absorption in the long run. The carrier used may also be a factor in the case. If the carrier consists of planer chips, then consideration might well be given to the size of the chips—perhaps the particular size used packs too much, giving a better opportunity for the sulphur deposited during revivification to cement the particles of oxide together. The nature of the carrier is one of the objections which has been presented to the use of blast-furnace slag as a carrier for oxide. It is claimed by some that such oxide is especially likely to mat together, giving a product which is heavy and difficult to handle. It may be that this type of material might be objectionable in some cases.

Another reason why revivification in place is neglected to such an extent may be that it has been tried and that results do not bear-out the performance expected. In such cases, it would be well to ascertain to what extent the introduction of air really affected the matter, and whether, as a fact, the results might not have been due to other conditions.

Timidity about introducing air into the gas may be a cause of hesitancy on the part of some operators. It may be feared that the quality of the gas will be unduly affected, and that the general public may learn of the practice and, misunderstanding the motive behind it, raise a clamour. There seems little real foundation, however, for such forebodings, as is evidenced by the fact that some of the best-operated plants have used the method for years without serious protest.

Revivification in the off-box was practised in only one of the plants inspected. The cost of purification in this plant was lower per unit of hydrogen sulphide in the gas than in any other plant. A brief description of the method as applied in this plant may be helpful.

A box is blown shortly after it begins to show foul, as tested by lead acetate paper. At that time the box is usually removing about 60 p.ct. of the H_2S in the gas (this would, of course, depend a great deal upon the nature of the oxide). The rate of circulation of air through the box is about 2000 c.ft. per minute (about double the maximum rate of gas flow). The air is blown through the box opposite to the direction of gas flow, just previous to the time of turning-off the box. The air is not cooled during circulation, nor is any steam introduced with the air. This was tried at one time but resulted in warping the grids. Temperature observations are taken on the air as it leaves the box. The blowing is continued until a 20° Fahr. rise in temperature is observed. At this point the fresh air supply is cut-off and the deoxygenated air circulation is continued until a decided drop in temperature is observed. Some trouble from channeling and local heating has been experienced. The oxide is usually removed from the box only twice before final discard. The oxide has a tendency to cake harder with this method than without. Even with such difficulties as are encountered, the superintendent in charge considers it the most economical means of revivification. As has been mentioned in the detailed description of the purifying equipment of this plant previously given, the boxes in which this method of revivification is used are arranged for reversible flow; but there is only one sequence of the boxes possible. The superintendent of the plant expresses the opinion that were the sequence of the boxes capable of alteration, together with the reversible flow, it would be possible to blow the boxes before they became very foul, and that channeling and local heating troubles, as well as caking of the oxide, would be largely avoided.

While this opinion as expressed may be conjecture only, it accords quite well with the conclusions drawn by O. B. Evans n

his paper, already referred to. It seems likely that the temperature rise during revivification dries-out the oxide to a considerable extent and thereby favours caking. Were a surface condenser or other means used whereby the air would become thoroughly saturated with moisture during circulation, it seems likely that the caking would be diminished, since the water-saturated air would have a tendency to keep the oxide moist.

This method, variously modified, has been used for years by several large gas companies; and from the experiences in the plant mentioned above, it would seem to merit more attention than it has received.

Revivification in place seems by far the preferable method. Its advantages might well, therefore, be studied by those who are not now using it.

(To be continued.)

Effect of a Lower Standard in Wisconsin.

As the result of a petition to the authorities by the Wisconsin Gas Association the companies of that State were permitted to lower the standard of gas to a monthly average of 520 B.Th.U., with a minimum of 500 B.Th.U., and a maximum of 546 B.Th.U. The experience of the Sheboygan Gas Company was related at the last convention of the Association by Mr. A. F. Davey—who stated that the Company decided to reduce it in three steps—the first being to 565 B.Th.U. When a figure of 550 B.Th.U. had been reached, the Company started men on a house-to-house inspection and adjustment of appliances. In most cases it was necessary to ream the orifice and adjust the air supply. These men had very few complaints made to them of any description. During the first eight months of 1920, when the average value was 597 B.Th.U., the gas sold per meter showed an increase of 15 p.ct., while the increase during the succeeding six months, when the average was 543 B.Th.U., was 10·1 p.ct. This was comparing one of the best years the Company had ever had for gas consumption during the early winter months with 1919, which was one of the worst. The Company analyzed the accounts of a number of their customers, and the result indicated that the average customer's bill had not been increased consequent on the reduction in the heating value of the gas. In fact, from the experience the Company have had to date under the reduced standard, they firmly believe the customer gets better service, and that his consumption has not been increased, so that the lowering of the standard is a forward step. A very important thing is to have a uniform quality of gas, with only slight variations from day to day, and with sufficient pressure at the back of it.

Cleaning a Deep Drip.

The Public Service Gas Company, of Jersey City (N.J.), recently found it impossible to pump several deep-well drips, owing to an accumulation of dirt in the cylinders; and the method of cleaning adopted has been explained by Mr. James M. Lane, in the "American Gas Association Monthly." The drips are at the foot of a tunnel shaft 110 ft. below ground level. The pumps are hand-operated, having 2-in. suction lines, with deep-well cylinders located about 2 ft. from the bottom. The 2-in. suction pipes had been placed inside 4-in. pipes, so that in case of trouble they could be removed by sealing the 4-in. lines. Both were slotted at the bottom, in order to permit a suction with the deep-well cylinder. When trouble arose, the 4-in. pipe was sealed-off, and the 2-in. pipe drawn-out. The bottom length of 2-in., the deep-well cylinder, and the slotted opening below it, were found to be packed solid with sediment, apparently out of the purifying boxes. This indicated that the bottom of the 4-in. pipe was also filled with the sediment. To blow-out with steam would have been unsatisfactory, and to remove the 4-in. line would have necessitated shutting-off a 24-in. main. A small bucket was therefore made out of a 2-in. nipple 8 in. long. A hole was drilled through the nipple, close to the bottom, and a pin riveted through. Two flaps were then hinged to the pin, so that as the bucket was lowered by a cable and the flaps forced down through the sediment, they opened-up; and as the bucket was raised, the weight of the sediment in it closed the flaps. It was necessary to add 4 ft. of 2-in. pipe to the top of the nipple, to give it weight enough to force it through the sediment. After the 4-in. main had been bailed clean, a steam hose was lowered, steam turned on, and the slots of the 4-in. pipe blown out. When the slots had been cleared, the balance of the sediment was allowed to settle for several hours, and the small amount which found its way back into the 4-in. pipe was again bailed out with the bucket.

A Large Holder for California.—The enormous growth of Los Angeles (Cal.), and the consequent increase in gas consumption, have led the Gas and Electric Corporation to plan the erection of a holder of 10 million c.ft. capacity, at an estimated cost of $1,000,000 complete. It is hoped to finish the foundation by September, so that the construction of the steel work may then be begun by the Bartlett-Hayward Company. The holder is to be constructed of the finest ingot iron, and will be approximately 270 ft. in diameter. When filled to its utmost capacity, it will rise 195 ft. into the air.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

The South Metropolitan Gas Bill: Returned from the Commons, with amendments, which were considered and agreed to. The Bill has now received the Royal Assent.

The Tendring Hundred Water and Gas Bill: Reported from the Select Committee, with amendments.

HOUSE OF COMMONS.

Progress of Bills.

The Harrogate Gas Bill, as amended, was considered, read the third time, and passed.

The St. Helens Corporation Bill, as amended: Considered; amendment made; read the third time; and passed.

The Nelson Corporation Bill: Read a second time and committed.

The Leicester Corporation Bill, as amended: Considered: and to be read the third time.

The Standing Orders not previously inquired into have been complied with in the case of the Wandsworth, Wimbledon, and Epsom District Gas Bill.

A petition has been deposited on behalf of the Waltham Abbey and Cheshunt Gas and Coke Company against the Lee Conservancy Bill.

Public Utility Companies (Capital Issues) Act, 1920.

A report was presented on an application to the Board of Trade under the Act by the Bournemouth Gas and Water Company.

HOUSE OF LORDS COMMITTEE.

MANCHESTER CORPORATION (GENERAL POWERS) BILL.

Tuesday, April 26.

(*Before* EARL WEMYSS, *Chairman*, *Lord* CRAVEN, *Lord* MONTEAGLE, *Lord* ROTHERHAM, and *Lord* STRATHSPEY.)

The gas proposals of this Bill are contained in Part III., in which powers are sought by the Manchester Corporation to erect additional gas-works and to acquire the undertaking of the Stretford Gas Company. For the former purpose it is proposed to borrow £1,640,000, repayable in forty years from the date of borrowing; and for the latter, £300,000, repayable in 35 years from the date of transfer. Additional sums are also required for the purchase of land and easements and for the purchase of ground rents, to be repaid in sixty years from the date of borrowing.

Counsel for the Bill were Mr. W. B. CLODE, K.C., Mr. W. E. TYLDESLEY JONES, K.C., and Mr. F. T. VILLIERS BAYLY. The opponents were the Stretford, Urmston, Ashton-upon-Mersey, and Sale Urban District Councils, and the Barton-upon-Irwell and Bucklow Rural District Councils, represented by Sir ELLIS J. GRIFFITH, K.C., and Mr. F. SCANLON.

Mr. CLODE, in opening the Bill for the promoters, said that the object of Part III. was to enable the Corporation to erect additional gas-works, to fix a standard of calorific power and a minimum price, and to improve the pressure in the mains. At the present time Manchester was in possession of a gas undertaking which was taken over from the Commissioners of Police, the then governing body, in 1842. The area of supply was 47½ square miles, the population 780,000, and the number of consumers, 192,112. The gas sold in the last financial year was 5612 million c.ft. In addition to the City of Manchester, the area included a number of outside districts; and the supply was given from works at Droylsden, Bradford Road, Rochdale Road, and Gaythorn. The coal gas capacity of these stations was: Bradford Road, 7 million cubic feet per diem; Rochdale Road, 5 millions; Gaythorne, 6½ millions; and Droylsden, half-a-million. This gave a nominal capacity of 19 million cubic feet per diem in all; but the actual capacity was only 85 p.ct. of the nominal—*i.e.*, 16,150,000 c.ft. As a stand-by there was a carburetted water-gas plant at Bradford Road, with a nominal capacity of 8 million cubic feet per diem, or 6,400,000 c.ft. actual. This plant, however, was expensive to work. The total actual capacity of the whole undertaking was, therefore, 22,550,000 c.ft. Additional coal-gas plant was in course of construction at Bradford Road, the capacity of which would be 8 million cubic feet per diem nominal, but 6,800,000 c.ft. actual; and it was hoped that this would be completed by the end of this year. The carburetted water-gas plant was almost normally used now, owing to the incapacity of the coal-gas plant; and its use should be discontinued as soon as possible from an economical point of view. If, owing to the deficiency of coal-gas plant, they would have to manufacture, as was estimated, 1394 million cubic feet of carburetted water gas, an additional cost of £154,269 would be incurred in excess of the cost of producing a corresponding amount of coal gas; and it was to save this great expense that the Corporation were asking for the powers embodied in the Bill. As to the demand, in existing circumstances, and with a pressure which was admittedly insufficient and defective, on a winter day this was about 27 million c.ft., or about 4 millions in excess of the capacity of the gas plant, even when the Bradford Road extensions were complete. This 27 million c.ft. could not be considered as the fair demand upon the plant—the true demand, which would be given if they had the capacity to give it, was 30 million c.ft. This necessitated restricting the issue of gas to consumers during certain times. As illustrative of this, they had at the present time a large number of complaints from consumers. In 1920, there were 70,700 complaints,

and in the previous year 83,257. The trouble was that they could not give the customers the supply they were entitled to. The demand for radiators, stoves, and cookers had been very exceptional. By March, 1920, there had been installed in Manchester 100,896 gas-cookers, 38,000 grillers, and 32,000 fires and radiators. There was a steady influx of orders for such fittings, which, unless the Corporation had extended powers for making coal gas, they would find it impossible to meet. Trying as was the present position, however, it was clear that it was going to be much more difficult in future, owing to the increase in the industrial use of gas. As to its domestic use, this must also increase in the future. Some 25,000 additional houses were required in Manchester, and 27,000 were needed to replace those which had fallen below the standard of what was considered by the Ministry of Health to be requisite; and the moment the older houses were replaced by newer ones, the demand upon the undertaking would no doubt be very much greater. Apart from this, the Corporation had a housing scheme of their own—comprising some 7000 houses. The demand could be imagined when the houses were built, and heaters and radiators installed. He believed a moderate estimate put it at 200 million a year. The Corporation, therefore, had visited the existing works to see what could be done. The Gaythorn works were in a very congested state, and could not be enlarged because they were surrounded by exceedingly valuable property. The carbonizing plant would also be worked-out in a few years, the railway accommodation was extremely restricted, and there seemed no possibility of doing anything to enlarge the works to what was required. The Rochdale Road works were also incapable of extension. They were in a densely populated district, the railway accommodation was extremely limited, and the life of the carbonizing plant was running out. The works at Droylsden could not be further extended, and an addition was already being carried out at the Bradford Road works. Having in view the present requirements for gas, and seeing what the future demand was likely to be, they had come to the conclusion that the only sound economical plan for them to adopt was to concentrate upon some spot where they could develop works and begin production on a large scale. They therefore wished to acquire a new site, which was situated partly in the township of Carrington and partly in that of Partington, upon which to develop their works. The decision had been come to after great deliberation on the part of the Corporation. The experts consulted had recommended that this was a sound and economical course to take; the majority of the Council were in favour of it—in fact, he believed all the members of the Council voted for it without exception; and the ratepayers had agreed. The site consisted of 161 acres, 61 of which were already the property of the Corporation. It was very easy of development, was suitable for the construction of gas-works (so far as foundations were concerned), and was outside the area of supply of the Stretford Gas Company, as well as that of the Manchester Corporation; it was near the Manchester Ship Canal, which was in itself an advantage; it was intersected by the Cheshire Lines Committee Railway (which communicated with every railway in England), and was contiguous to what was the Partington coal basin of the Canal; while there were good roads all round. It was situated about seven miles from Manchester; and the main to Manchester would be laid under at least four miles of road, and would not be an unusual disturbance to property. They asked permission to acquire the site and inaugurate their policy of concentrating upon it. It was intended to begin with works with a nominal capacity of 8,000,000 c.ft., but ultimately they would be developed to a nominal capacity of 40,000,000 c.ft. This, it was believed, would not be necessary within the next twenty years; but the necessity for doing something at once was urgent. The cost would be, in addition to the price of the land, £1,250,000 for works, £350,000 for mains, and about £40,000 for the construction of bridges. The Lord Chairman had thought the £6,000,000 originally asked for in the Bill looked at first to be excessive; but it was not proposed to spend all this sum at present. They were now proposing to spend £1,640,000, which was the sum of the figures already mentioned. The scheme would not be so expensive as it looked, because they would be able to avoid the normal use of the carburetted water-gas plant, which was so expensive. In this connection there would be a saving of £154,269 per annum.

In answer to the CHAIRMAN, Counsel said the carburetted water-gas plant would be kept in reserve in case of emergency, but would not be used normally.

Continuing, Counsel said that interest and sinking fund at 7·31 p.ct. on the sum mentioned would be about £122,296 per annum. If this were subtracted from the £154,269. it would seem that a net saving of over £31,000 would be effected; and when it was considered how and why the money was to be spent, it was not so expensive as it looked at first sight.

THE STRETFORD GAS COMPANY'S WORKS.

Having carried the matter so far, the Corporation, after looking at the lay-out of the district, had decided to negotiate for the purchase of the Stretford Gas Company's undertaking. The main from the new site into Manchester would intersect the Stretford Company's area. The Company had a considerable, but not a large, undertaking, and dealt with a demand of about 414,000,000 c.ft. per annum. The Company had done well for the district; but through operating on a smaller scale than that of the Manchester Corporation, their costs of manufacture were considerably higher than in Manchester—comparable figures being 2s. 6d. per 1000 c.ft. in the case of the Stretford Company and 1s. 7d. in the case of the Corporation. The Company's area of supply covered about 17 square miles, with a population of about 90,000 and 13,418 consumers—a district in which no doubt there were possibilities of development. The Corporation considered that they could do good both to themselves and Stretford by purchasing the undertaking combining it with their own, and dealing with the two areas from the new works. The Company also saw that it would be a good thing for both parties, and for the consumers generally. Accordingly they agreed to sell their undertaking for something like £285,000; the Corporation taking over as well £10,000 of debentures. The agreement was scheduled to the Bill. The negotiations for the purchase of the undertaking took place in the summer of 1919; and the agreement was approved in March, 1920. Generally speaking, the terms of purchase gave the shareholders slightly more than the average price they had paid for it. The shareholders voted £10,000 to the Directors as compensation. The Corporation took over the staff; and in certain instances paid superannuation and retirement allowances. Looking at the transfer from the point of view of the price of gas only—the maximum price in Stretford itself was 5s. per 1000 c.ft. and in the remainder of the area 5s. 6d., while the maximum price in Manchester was 5s.—it did not seem to make much difference to the Stretford consumers. These did not represent the actual charges, however. The average price charged in Stretford in 1920 was 4s. 7d. per 1000 c.ft., against 3s. 8½d. in Manchester. This would represent a saving of £20,000 per annum to the Stretford consumers if they were charged the same price as the Manchester consumers; and, in addition, they would be supplied with cookers free—these being charged for by the Stretford Company, but not by the Corporation. The Stretford Urban District Council had objected to the purchase of the undertaking by the Corporation. It seemed to him that the only other alternative was for the Stretford Council to buy the undertaking, and to keep on doing what the Company had come to the conclusion they could not do successfully. Assuming the Urban District Council were taking over the undertaking, however, they could not even supply on anything like such good terms as the Company, because, if they were paying the same price as Manchester, the additional charges they would be called upon to pay would represent an immediate increase of 6d. per 1000 c.ft. on the price of gas. On the other hand, the Company were under limitation as regards dividends, and could only take out for capital from the profits a sum of £10,220. If the District Council were to buy the undertaking, the capital charges on the sum paid for it alone would be £21,000; and the difference between £10,000 and £21,000 would put 6d. per 1000 c.ft. on the price of gas.

Dealing with the petitions, Counsel said there were several deposited, but they were not apparently represented, except the Stretford Urban District Council and other Urban and Rural District Councils. In the petition, which was a combined one, it was said that the money taken from the gas consumers in Stretford would be applied to the relief of rates in Manchester. It had recently been decided by the Manchester Corporation that to take money from either of their undertakings for the relief of rates was wrong in principle, and a resolution had been passed to this effect. It was also said that the mains would cause disturbance to the streets; but there was nothing to show that this would be the case and the Councils were entitled to reasonable protection. Other provisions in the gas portion of the Bill were for fixing the calorific power, to fix the maximum price, and to increase the pressure. At present Manchester had no calorific standard, no illuminating standard, and no maximum price. Objection was taken in the petition to clauses 35, 36, and 39, which asked that the calorific power of the gas should be fixed at 450 B.Th.U., that the pressure should be 2 inches and that the maximum price should be 5s. per 1000 c.ft. The Corporation were asking that these should be fixed in order that they could go to the Board of Trade, under the Gas Regulation Act, for an Order to charge upon the therm basis. The petitioners also asked that in the event of their acquiring the Company's undertaking the Corporation should be put under an obligation to give them a supply in bulk of all the gas they might require for distribution throughout the present limits of the Company on terms to be settled, failing agreement, by arbitration. They were, therefore, asking to be installed as middlemen between Manchester and the consumer in the Stretford Company's area, simply because they were the Stretford Urban District Council. He did not think the petitioners were opposing the Bill on what he called economic grounds. In the petition of the Cheshire County Council, which was not proceeded with, it was suggested that the inclusion of the new parishes in the area of supply of the Manchester Corporation gas undertaking would be founded on by the Corporation in future as an element in support of any proposed incorporation of such parishes in the City of Manchester; and he could not help thinking that at bottom this was the real reason the Stretford and other Councils were opposing.

Wednesday, April 27.

Evidence was given to-day by

Alderman *William Kay* (Lord Mayor of Manchester, and Chairman of the Gas Committee of the Corporation), who, in examination by Mr. TYLDESLEY JONES, said that the outstanding debt of the gas undertaking was £604,349 at the end of the year 1920, in respect of a capital expenditure of over £3,200,000; so that the financial position compared favourably with any other large undertaking in the kingdom. He confirmed Mr. Clode's statement that the Corporation had passed a resolution not to apply the profits of their undertakings to the relief of rates. As to the benefit which would be derived by the consumers in the Stretford area by the acquisition of the Company's undertaking, witness said that the Corporation's gas area included a small part of Stretford; and there the supply was cheaper than in the remainder of the urban district served by the Company, in addition to which the consumers had the advantage of free meters and free cookers—an advantage not enjoyed by the consumers in the Company's area. At the present time the Corporation were in an unsatisfactory condition from the point of view of the pressure at which they could supply gas, due to the fact that the plant was not sufficient; and it was essential that this should be extended. An extension of the plant was already being carried out at the Bradford Road works; and it was hoped that a portion of this would be ready by Christmas. The extension of the Bradford Road works, however, would not be sufficient to meet future demands; so that the new works were essential.

In answer to the Marquis of SLIGO, witness said that the Rochdale Road and Gaythorn works would not be used as manufacturing centres when the new works were in operation, but only for gas distribution purposes.

Mr. TYLDESLEY JONES, on this point, recalled the action of the Gas Light and Coke Company in London, who had swept away a number of small gas-works in the centre of London, and built large works at Beckton, from which the supply was now obtained.

Witness, continuing his evidence, said that 30,000 complaints had been received from gas consumers within the three months ended December last—all due to the Corporation's inability, with their existing

works, to meet the demand. They were, therefore, unable to earn the revenue they should do. With a larger revenue, costs and prices could be reduced. In regard to the new houses, which had been referred to by Mr. Clode, it was estimated that when these were built they would require an additional 1,400,000,000 c.ft. of gas per annum. In workmen's houses gas was generally preferred for both lighting and cooking purposes. Dealing with the purchase of the Stretford Company's undertaking, this was considered desirable from the point of view of the consumers. The works were badly placed, and there was no railway communication with them. They were built many years ago, at which time it was never anticipated that the demand would reach its present figure; and it was not desirable to extend them on the present site. Undoubtedly the demand for gas in Stretford would increase, in view of its proximity to Manchester, the Manchester Ship Canal, and Trafford Park. The latter area had developed enormously as an industrial centre. The demand could not be met by any works in Stretford. If the area were to be supplied by a separate undertaking, they would have to erect new works outside; and it would be lamentable if they had to erect new works on a site near the proposed Manchester works. The effect of the transfer of the undertaking to the Corporation would be an immediate reduction of 5d. per 1000 c.ft. to the consumers in the Stretford area, in addition to which free meters and cookers would be supplied, representing another reduction of 3d. per 1000 c.ft. The question of the Stretford works taking a supply in bulk from the Corporation had been raised by the petitioners; but he considered this was not a feasible policy to adopt, as it would end in conflict with the various local authorities concerned. The Droylsden works of the Corporation were the property of a small undertaking acquired by them forty years ago, and had been a complete success—the people at Droylsden not having raised any objection.

Mr. Scanlon, for the petitioners, cross-examining, put a number of questions to the witness to show that the object of the Corporation scheme was primarily to provide a larger area of supply for the benefit of Manchester.

Witness agreed, but pointed out that the consumers of Stretford would also get the advantage of a cheaper supply. He wanted to supply the Company's area on the same terms as Manchester.

Mr. Scanlon commented on the expenditure of £1,640,000 on the new works, which would only yield 8 million c.ft. of gas per day. Having in view the fact that the works would not be put into operation for four or five years, and that the Corporation had difficulty in supplying the present demands of Manchester, when that period had elapsed the whole of the 8 millions would be required in Manchester, and the consumers in the Stretford area would not get a larger supply than they were receiving at present.

Witness said that this was not necessarily the case, because ultimately the output of the new works would be 40 million c.ft. per day, and the Gas Committee would use their discretion as to whether the initial output should be 8 millions per day or more. The additional cost of providing for a larger amount of gas would be very small compared with the initial outlay. As to the supply in Manchester, there was storage capacity on one of the works for 24 million c.ft., and it was only by having large storage capacity that the Corporation were able to carry on at all. During Saturday and Sunday, the consumption in Manchester—which was 30 millions per day—dropped 6 or 7 millions; but the usual daily output was maintained, and the surplus stored, in order to meet the demand during the remaining days of the week. The demand of 30 million c.ft. per day was only made during the winter months.

Asked whether the Corporation had consulted the local authorities concerned when they approached the Stretford Company with regard to purchase, witness said he did not know that the local authorities had a proprietary right to the undertaking, which was the property of the shareholders, and therefore did not consider it necessary.

Mr. Scanlon suggested that the Corporation were working behind the backs of the local authorities, and that they had attempted to do the same thing in 1914, when they had tried to purchase the undertaking of the Trafford Power & Light Supply, Ltd., but failed.

Witness said that was due to the fact that a clause was inserted in the Stretford Act of 1904 which gave the Stretford Council the right to sanction any sale of the Company's undertaking.

Dealing with the price of gas in the two areas in the past, Counsel said that in 1910 the price in Stretford was 2s. 3d. per 1000 c.ft., as against 2s. 6d. in Manchester. From 1911 to 1914 the price in Stretford was 2s. 3d., while in 1914 the price in Manchester was 2s. 5d. In 1915 the prices were 2s. 7d. and 2s. 11d. respectively, the latter figure being subject to a reduction of 2d. It would be seen, therefore, that the Stretford Company supplied as cheaply as the Manchester Corporation, and in some instances more cheaply.

Witness replied that this did not apply to Manchester proper, but to the out-districts. As to the differentiation in price in Manchester proper and the out-districts, it was proposed in the Bill to charge more in Stretford, owing to the extra cost of distribution brought about by the scattered nature of the houses in the district and the smaller number of consumers per mile of main.

Counsel asked whether, in view of the fact that the new works were nearer the Stretford area than the Manchester area, it was necessary to charge more in Stretford.

Witness said it was, because the main which would pass through the Stretford area to supply Manchester was a high-pressure main, and would not be used for distribution.

Asked whether he would agree to the insertion of a clause in the Bill providing that the charges in the outside areas should not be greater than in Manchester, witness said he was not able to agree to that on his own initiative. As to the insertion of a clause prohibiting the profits of the undertaking being used for the relief of rates in Manchester, he had no objection personally, but he would not pledge the Corporation.

In reply to a remark by Mr. Scanlon, that the Stretford Urban District Council did not desire interference from Manchester, witness said he did not think the consumers of gas in Stretford would support this point of view. The Stretford works could not be used as a separate unit so economically as by the Corporation. For instance, there would be a huge difference in the amount of coal required by each undertaking. He also expressed disagreement with Mr. Scanlon's suggestion that in normal times—having in view the fact that before the war Stretford had supplied more cheaply than Manchester—it was reasonable to assume that gas could be supplied as cheaply by the Stretford works as by those of the Manchester Corporation.

Mr. Tyldesley Jones, at this point, said the members of the Corporation present had no objection to the principle that there should be no differentiation in price. This, of course, was only in the event of the Committee's approval of the purchase; and if sanction were refused he asked that nothing should be added to the Bill as regards that principle as affecting the present conditions.

Mr. Scanlon asked witness what objection he would have if the Stretford Urban District Council wished to purchase the undertaking within their own area and manufacture and supply gas themselves.

Witness said he did not suppose he would have had a word to say if the Council had approached the Company with this object. The trouble was that the Manchester Corporation had forestalled them; and it seemed to him that their attitude was that of a dog in a manger. He agreed, however, that the purchase of the undertaking was not essential to the Corporation's scheme; but it would improve their scheme.

Re-examined by Mr. Tyldesley Jones, witness said that although the price in 1910 was 2s. 3d. per 1000 c.ft. in Stretford and 2s. 6d. in Manchester, there was a reduction to consumers of 2d. per 1000 c.ft. if they paid their bills within a month in Manchester; and the provision of meters and cookers free represented another 3d. per 1000 c.ft. Neither of these advantages was given to the Stretford consumers; so that actually the price was cheaper in the outside districts of Manchester. To-day the price in Stretford was 5s., against 4s. 9d. in the outside districts of the Corporation; and, taking into account the extra reductions of 2d. and 3d., the Corporation's consumers were actually paying 8d. less. He could not foresee a return to normal conditions of costs. The effect of the war had been that charges had affected small undertakings much more severely than the larger ones, and this must be so in the future. As to the purchase of the Stretford undertaking by the local authorities, under the Public Health Act, each of the local authorities could purchase by agreement that part of the undertaking which was in their own area, and therefore it would necessitate the formation of a joint board, or something of the kind. If the Corporation owned the Stretford undertaking, they could shut-down the Stretford works during the summer and only use them for distribution purposes; the gas being supplied from the Corporation's works for the whole area. Mains were already in existence near the Stretford works, and these could be linked-up with these works at a very small cost. As to the question of wayleaves through the district, it was the Corporation's experience that they were heavily rated in respect of mains passing through the outside districts they were already supplying; and the rates they paid were amply sufficient to cover any possible inconvenience sustained while the mains were being put down.

In answer to the Marquis of Sligo, witness said that the passing of the Bill would at once result in a reduction of price to the consumers in the present Stretford Company's area.

Mr. *William Newbigging* (Consulting Gas Engineer to the Corporation) handed in tables dealing with the capacity of the coal-gas and water-gas plants at the various works of the Corporation, and a comparison of the Manchester and Stretford gas accounts, as follows:

In regard to the existing coal-gas plant, there was a difference of 15 p.ct. between actual and nominal capacity; the actual capacity being 4522 million c ft. per annum This, again, had to be corrected, due to losses in transmission; and the actual quantity sold was 4302 million c.ft. The nominal capacity of the water-gas plant was based on the use of 3 gallons of oil per 1000 c.ft.; but they were in fact using 1 gallon of oil per 1000 c.ft. A reduction of 1 gallon of oil per 1000 c.ft. represented 10 p.ct. reduction in the capacity of the plant; so that the reduction of 2 gallons meant a reduction in the capacity of 20 p.ct. In the case of the water-gas plant, therefore, the difference between nominal and actual capacity was 20 p.ct. instead of 15 p.ct. In Manchester a typical winter day's consumption was 30 million c.ft., at a pressure of 30-10ths. They were not meeting this demand to-day; and there was a large unsatisfied demand. They, therefore, had to use water-gas plant, which was a very expensive method of producing gas. In order to relieve the situation a little,

Statement showing Nominal and Actual Capacities in Million Cubic Feet per Diem of the Coal-Gas and Water-Gas Plants at the Bradford Road, Gaythorn, Rochdale Road, and Droylsden Stations and the Proposed Works at Partington.

——	Nominal Capacity per Diem.	Actual Capacity per Diem. 85 p.ct. of Nominal.	Annual Make. Actual Capacity × 280.	Converted to Gas Sold. Annual Make ÷ 1·076.
	Million Cubic Feet.	Million Cubic Feet.	Million Cubic Feet.	Million Cubic Feet.
Coal-Gas Plant.				
Bradford Road .	7·0	..	..	..
Gaythorn . . .	6·5	..	..	..
Rochdale Road .	5·0	..	..	..
Droylsden . . .	·5	..	..	..
	19·0	16·15	4522	4203
Bradford Road (under construction)	8·0	6·80	1904	1770
	27·0	22·95	6426	5973
Water-Gas Plant. Bradford Road. .	8·0	6·40	1500	1394
	35·0	29·35	7926	7367
Partington . . .	8·0	6·80	1904	1770
	43·0	36·15	9830	9137

Yearly Capacity of Manufacturing Plant, Converted to Sales Basis, Compared with Demand.

Year ending March 31.	Coal-Gas Plant.				Carburetted Water Gas.	Demand.		
	Present Capacity.	Additional Capacities.		Total.	Emergency Plant.	Manchester.	Stretford (if supplied by Manchester).	Total.
		Bradford Road.	Partington.					
	Millions Cub. Ft.	Millions Cub. Ft.	Millions Cub. Ft.	Millions Cub. Ft.	Millions Cub. Ft.	Millions Cub. Ft.	Millions Cub. Ft.	Millions Cub. Ft.
1921	4203	..	..	4203	1394	6052	..	6052
1922	4203	204	..	4407	1394	6204	..	6204
1923	4203	1770	..	5973	1394	6355	489	6844
1924	4203	1770	..	5973	1394	6506	501	7007
1925	4203	1770	..	5973	*1394	6657	513	7170
1926	4203	1770	1770	7743	..	6809	524	7333
1927	4203	1770	1770	7743	..	6960	536	7496
1928	4203	1770	1770	7743	..	7111	548	7659
1929	4203	1770	1770	7743	..	7263	559	7822
1930	4203	1770	1770	7743	..	7414	571	7985
1931	4203	1770	1770	7743	..	7565	583	8148

* From this point used as an emergency plant only.

Manchester and Stretford Gas Accounts Compared.

	Manchester. Year to March 31, 1920.		Stretford. Year to Dec. 31, 1919.	
	Amount.	Per 1000 C.Ft. Sold.	Amount.	Per 1000 C.Ft. Sold.
	£	d.	£	d.
Manufacture—				
Coal, oil, coke, &c.	649,961	27·80	51,916	30·07
Less coke	333,427	14·26	20,133	11·66
,, tar	79,696	3·41	3,904	2·26
,, sulphate, &c.	32,067	1·37	1,880	1·09
Total residuals	445,190	19 04	25,917	15·01
Net cost of coal, &c.	204,771	8·76	25,999	15·06
Working expenses—				
Carbonizing wages	86,658	3·71	8,203	4·75
Purification	7,226	0·31	1,695	0·98
Repairs and maintenance	133,821	5 72	14,774	8·56
Salaries	15,290	0 65	1,707	0·99
Total working expenses	242,995	10·39	26,379	15·28
Net cost of gas in holders	447,766	19·15	52,378	30·34
Percentage of water gas	25 p.ct.		14 p.ct.	
Distribution—				
Salaries and wages	54,833	2·34	1,554	0·90
Repairs, &c.—				
Mains and services	12,817	0·55	3,674	2·13
Meters	33,919	1·45	4,812	2·79
Stoves	31,462	1·35	5,774	3·35
Private lighting	4,403	0·19	..	..
Cost of distribution	137,434	5·88	15,814	9·17
Rent, rates, and taxes	78,584	3·37	1,543	0·89
Management—				
Salaries and wages	12,377	0·53	847*	0·49
			1,576	0·91
Collection	21,627	0 92	1,178	0·68
General charges	22,841	0·98	2,942	1·71
Cost of management	56,845	2·43	6,543	3·79
Bad debts	336	0·02	14	0 01
Net cost of gas delivered	720,965	30·85	76,292	44·20
Revenue from gas	974,719	41 69	87,797	50·86
Revenue from stove rents, &c.	11,558	0·49	3,350	1·94
	986,277	42·18	91,147	52·80
Deducting net cost	720,965	30·85	76,292	44·20
Gross profits	265,312	11·33	14,855	8·60

* Directors, &c.

they were extending the works at Bradford Road; but they could not extend them further, and therefore had to go to the new site to meet future demands. He agreed with the figure of £154,269 as representing the economy to be effected by the use of coal gas in the place of carburetted water gas. As to the amalgamation of the Stretford undertaking with Manchester, if low-priced gas was any consideration at all, this was a desirable course. He would not recommend the extension of the Stretford works if this course could be avoided, owing to the unsuitability; and if the undertaking were carried on separately, the Stretford works would not be able to meet the demand for any length of time without extension. As to the alternative of a supply in bulk from Manchester, he only knew of two instances of a bulk supply on this scale; and in both cases they were unsatisfactory. One was the case of the Little Hulton Company, which received a supply of coke-oven gas from Lord Ellesmere's coke-ovens. This was a constant source of annoyance to the consumers—it was not sufficient, it was impure, and was altogether unsatisfactory. The other case was the Barnsley Gas Company, who gave a supply to a neighbouring concern. There was constant bickering between suppliers and distributors, which ended in the distributors establishing their own works.

Sir ELLIS GRIFFITH, cross-examining, said that neither of the difficulties mentioned would apply in the present case. There could not be complaints as to insufficiency, pressure, &c., here.

Witness said that if the Stretford undertaking did arrange for a supply in bulk from Manchester, the Corporation would do their best to supply properly. It was quite possible, however, that bickering might arise. Answering further questions, he said that if a calorific standard of 500 B.Th.U. were imposed, instead of 450, as suggested in the Bill, the cost of producing gas would increase in direct proportion.

Sir ELLIS GRIFFITH, dealing with the question of the unsuitability of the works, said that there was a railway within 150 yards of the Stretford works; but witness said it was impossible to get a railway siding into the works.

Counsel also pressed the point that it was the aim of the Corporation merely to acquire the undertaking for the benefit of Manchester, and said that they were proposing to spend £300,000 for the Stretford works, which would ultimately become only a distributing centre. Witness pointed out, however, that the mains, &c., were already in existence, and that were the Stretford works not in existence the Corporation would have to spend a similar amount to provide a distributing centre, mains, &c.

Thursday, April 28.

Sir ELLIS GRIFFITH, continuing his cross-examination of Mr. Newbigging, mentioned a number of gas undertakings which were supplying or receiving gas in bulk, with a view to showing that it was quite an ordinary feature at the present time.

Dealing with the tables submitted by witness, Sir Ellis, turning to Table I., said that this showed that, deducting the Partington figure from the total daily capacity of the undertaking, there would still be a daily capacity of something under 30 million c.ft. Therefore, even with the emergency plant in operation, the Corporation would not be able to meet their present demand until the new works at Partington were in operation, in 1926; and Stretford would not be any better off until 1926.

Witness pointed out that the daily demand of 30 million c.ft. per day was only made during the winter months; and the Stretford works would only be operated during that period. At the same time, he was inclined to agree that, during the next two or three years, the position in both Manchester and Stretford would not be quite so satisfactory as it should be. Continuing, witness said that he had been fortunate in estimating the cost of the new works at Partington, in that he had been constructing a unit of the same size at the Bradford Road works, and had based the cost of the Partington works on the costs incurred at Bradford Road. Storage was included in the item for works; and the estimated cost of storage facilities was £400,000. Counsel suggested that, owing to the present abnormal times, the estimates for the new works might vary within 15 or 20 p.ct. on either side, as it was extremely difficult to estimate the cost of works to be carried out over a period of five years. Witness, however, said that the estimates were as near as he had been able to get; and he thought a suggested error to the extent of 10 p.ct. was too big.

In re-examination by Mr. CLODE, witness said that his estimates of demand for the period prior to the time at which the new works would be in operation were based on the winter demand; and with the aid of the Stretford works they would still be able to give an ample supply all over the district. The figures given in Table IV. for the cost of gas in their holders would illustrate the economies which would be effected, and the benefits to be derived by the Stretford people. The figures for 1920-21 would show even greater economy. The Cheshire Railway, which ran by the Stretford works, was an express line; and the Railway Company had refused a siding to the Gas Company. It was not possible to get a siding into the gas-works; and even if it were, it would be an extravagant waste of money. As to the calorific value being 450 B.Th.U., such a gas was likely to be best for the district. The Stretford Gas Company had been giving a supply of 450 B.Th.U. gas, whereas their maximum was 500. Had it been a 500 B.Th.U. gas, their price would have been very much higher.

Mr. *W. Doig Gibb* corroborated the evidence of Mr. Newbigging. He had never seen a clearer case in which advantage would accrue from the merging of two undertakings. The Stretford Company could not compete with the Manchester Corporation undertaking, however well it was managed. The new site was a splendid one for gas-works. The estimated expenditure of £1,640,000 was fully justified; and the

economy resulting from the disuse of the water-gas plant was a very serious item. He had studied the tables handed in by Mr. Newbigging, and agreed with them. He explained to the Committee the reasons which brought about the reduction in calorific value of gas supplied for certain purposes during the war, from 500 to 450 B.Th.U. If the calorific value were increased, the price would be correspondingly higher. The maximum price of 5s. per 1000 c.ft., to his mind, was exceedingly low.

Sir Ellis Griffith, in cross-examination, pointed out that the calorific standard of the South Metropolitan Company's gas was 550 B.Th.U.; and that, as 450 B.Th.U. was a war emergency standard, and nobody would have thought of reducing the standard but for the war, it was the tendency now to adopt it as a general figure. As to the price decreasing as the demand increased, counsel pointed out that at Altrincham, where there was a small undertaking supplying 800,000 c.ft. of gas per day, the price was 2s. 11d. per 1000 c.ft., which was contrary to the evidence given; but witness said he had no knowledge of this. He did not agree that in the present abnormal times the estimates were likely to vary 15 or 20 p.ct.; but he would concede a figure of 10 p.ct. in respect of contingencies.

Re-examined by Mr. Clode, witness agreed that the price of gas did not depend solely upon the number of consumers. There were other circumstances—such, for instance, as the price obtained for residuals. In Altrincham the gas undertaking was in the fortunate position of having had the works renewed in 1915.

Mr. *Arthur Collins* (City Treasurer of Birmingham) said he had gone into the whole financial position of Manchester and Stretford *vis-à-vis* the suggestion of the gas extension. He handed-in a number of tables dealing with the undertakings of the Stretford Company and the Manchester Corporation. The first of these was a balance-sheet of each undertaking; and he directed attention to the great excess of assets on the Manchester balance-sheet. For instance, the item for land, buildings, and plant amounted to 3¼ millions, whereas the liabilities on the undertaking only amounted to £810,000. There was, therefore, a surplus of assets of £2,182,000 wiped-off by amortization of debt, and no less than £267,000 for profits applied in extension of the works where borrowing powers were not sought or granted. It was one of the strongest balance-sheets he had ever had to examine. The undertaking had a renewal fund in hand of £150,000. and a reserve fund in hand of £38,000. In the case of Stretford, being a gas company, there was not such an excess of asset value in the undertaking. The capital value was £176,000; and the capital outstanding was £163,000. He had considered the Partington scheme from a financial point of view, without prejudice. If he had had any prejudice at all, it would rather have been against the scheme, because it was necessary to avoid capital expenditure if possible in these days. But the more he went into it, the more satisfied he became that it was a case where capital expenditure could not be avoided; and he was satisfied that by no other means could the capital be kept to so small an amount as by the establishment of the Partington works. It was on his advice that the Corporation had reduced the figure asked for from £6,000,000 to £1,640,000. If the experience afterwards was that additional capital was necessary, the Corporation could make application to the appropriate Government Department. To seek another smaller site in some other part of Manchester on present prices would cost at least as much as the first unit at Partington, with not anything like the facilities for cheap transport which the site gave. Having costed the accounts of a good many gas undertakings, he attached very considerable importance to cheap transport facilities—both inside and outside the gas-works. As to the borrowing capacity, in the last financial year the Corporation had borrowed £4,000,000 locally at prices not exceeding 6 p.ct.; so that it was well within their capacity to borrow the requisite sum. Table II. showed comparative production costs in Manchester and Stretford. It was clearly brought out that the larger the station the cheaper the cost of production. Other tables handed in dealt with the progress during the past twenty years, and the future normal development based on past results. As showing the retardation effect of the war, the actual amount of gas sold, in thousands of cubic feet, was given as 5,611,903 in 1920, whereas normally in Manchester it should be 6,346,893.

On the general question, witness pointed out that the Manchester Corporation had lent over £5,000,000 to the Manchester Ship Canal. Indeed, it was only by the aid of the Corporation that the Manchester Ship Canal was finished at all. The development in the Davyhulme area was entirely due to the canal; and, therefore, it seemed natural that Manchester should wish to acquire the potential profits from gas supplies in the area, seeing that it was their capital which enabled the works to settle there.

Tables of statistics of the combined undertakings, and also with regard to the capital and revenue accounts, as well as a schedule of current charges, were handed-in, with the object of further demonstrating the advantages to be gained by combining the undertakings.

Continuing, witness said he was not sure whether, if the Stretford Company's undertaking were offered to the local authorities to-morrow, they would be able to get the money to pay for it. There were six small authorities, with a combined rateable value of £600,000; and his experience was that in these very hard times they could only get money even for housing by borrowing from the Government. Further, they would have to form a joint board to run the undertaking, and a joint board was always at a disadvantage. He himself had been unable to raise money for joint boards, with a credit quite as good as here, at 7½ p.ct. If the local authorities went to arbitration, he did not think they would get the undertaking for £300,000.

As showing the advantage to the consumers which would result from the acquisition of the Stretford undertaking by the Corporation, the table top of next column was submitted.

Summary of the Financial Effect of the Proposed Extension of the Manchester Gas Undertaking, and the Purchase of the Stretford Gas Company.

A.	Benefit to Stretford consumers of lower prices for gas:		
	1. Quantity consumed, 1920, 466,067,000 c.ft. at 4s. 7d. charged by Company (approx.)		£106,807
	2. Quantity consumed, 1920, 466,067,000 c.ft. at 3s. 8·66d., if charged by Corporation at Manchester prices		86,727
	3. Annual gain to Stretford consumers, on gas consumed		£20,080
B.	Annual gain to Stretford consumers by abolition of gas cooker rentals (1920 charges)		£1,206
C.	Total benefits obtained by Stretford consumers from Manchester supply		£21,286
D.	Benefit to Manchester by closing the Stretford works during eight months:		
	1. Cost of Manchester supply, on 1920 data:		
	(*a*) Annual loan charges on purchase price, £300,000.	£21,979	
	(*b*) Production cost of Manchester coal gas to meet summer demand, 276,000,000 c.ft. at 1s. 4·08d.	£18,429	
	(*c*) Production cost of Stretford gas to meet winter demand, 191,000,000 c.ft. at 2s. 6·34d.	24,145	
	(*d*) Total cost of gas required, 466 millions		42,574
	(*e*) Distribution costs, at Stretford figures, 11d. per 1000 c.ft.		21,361
	(*f*) Total annual expenditure on supply to Stretford		£85,914
	2.		
	(*a*) Revenue at Manchester prices, as in A2 above	£86,727	
	(*b*) Revenue from hire of gas-fires	1,000	
			87,727
	3. Annual gain to Manchester by economies in production		£1,813
E.	Immediate benefit to the whole area by the substitution of Partington coal gas for water gas:		
	1. Cost of carburetted water gas at existing Manchester works, per 1000 c.ft. sold (adjusted to heat basis as proposed by the Bill)		3/4·79
	2. Cost of Partington coal gas		1/2·23
	3. Saving per 1000 c.ft.		2/2·56
	4. Saving on quantity of carburetted water gas made, 1500 millions, equivalent to 1394 million c.ft. sold		£154,269
	5. Less annual loan charges on the Partington new works (£1,680,000)		122,796
	6. Net annual saving by first use of first instalment at Partington		£31,473
F.	Future saving by further use of Partington works cannot be closely estimated; but it is anticipated that gas can be produced there much more cheaply than at the existing works and a saving of only 1d. per 1000 c.ft. on the present cost of 1s. 4d. and on the present sales of 6 thousand million c.ft. would realize an annual sum of		£25,000

In the afternoon,

The Chairman said he could not quite see what stood in the way of a compromise. If the Bill were allowed, subject to gas being charged the same price over the whole area, and that no money should go to the relief of rates, he did not see the difficulty.

Sir Ellis Griffiths said that the Company's area covered six local authorities; and they were anxious to retain it as the lighting authority, for reasons partly financial and partly political.

The Chairman: You are afraid it would be tying your hands, and you would be more readily eaten-up?

Sir Ellis Griffith said that was exactly the position. They would put no obstacle in the way of the construction part of the Bill; and if the Corporation came through the Stretford district, no doubt the Committee would give that power. As to the purchase, the proposal should be rejected; and then the local authorities hoped to buy the undertaking. If the Manchester Corporation wished to buy the undertaking they must come to Parliament; but if the local authorities bought the Company this was not necessary, because they were the lighting authority. The essence of the Bill, of course, was municipal trading outside the Manchester area. What he submitted as a fair compromise, whereby he gave up some parts of his rights, was that the part of the Bill relating to the Company's undertaking should be thrown out; that the local authorities would in due course proceed to buy the undertaking; and if and when the Partington scheme was ready they should have the option of buying gas in bulk. The Corporation could not supply the Stretford area until 1926; and he asked that the local authorities should be allowed to go on until then. They would take the risk.

In reply to the Chairman, Sir Ellis said he would like to make it compulsory for the Corporation to supply in bulk. He wanted to be master of his own house. If he took the gas from Manchester, he would be a distributing authority—*i.e.*, a middleman. He asked that Manchester should supply in bulk, and Stretford would supply the customers.

The Chairman said as the argument was that Manchester could not supply their own people, how could they be expected to supply Stretford in bulk?

Sir Ellis Griffith said they could after six years. Manchester was seeking powers for municipal trading; and he asked the Committee not to ignore the fact that his clients represented the unanimous view of the different areas.

Mr. Clode replied that the Corporation had a formal agreement with the Company; and now the local authorities were asking that the Bill should not be passed. Nothing that the local authorities would or could do in the future would be prevented by the Bill passing in its present form. They asked that the part of the Bill dealing with the purchase should be rejected, in order that they might, if they could get the six authorities into line and secure the sanction of Parliament, purchase the undertaking. As to municipal trading, he (Mr. Clode) pointed out that Parliament had authorized the purchase of the Cheshire Water Company by the Corporation, which was now supplying water in this area; so that at the time the Bill was promoted there was no disinclination to allow them to be purveyors of these primary

necessaries to their neighbours. The history of Manchester showed that they were now asking a very moderate extension of what had been done in the past in regard to public utility supplies. The Committee were asked to reject the Stretford purchase on the supposition that the authorities might be able to do something which they could not guarantee, and which had been proved to be economically unsound. Assuming the Bill was to pass, and the Committee were to indicate that the local authorities should have a chance (say) of forming a joint board within four or five years—or perhaps two—it would be possible for the Committee to deal with it if they came to that conclusion. It would be perfectly easy to protect the position of the local authorities by the Bill—*i.e.*, the Bill could be passed, providing that within a certain time, if the joint board were formed, and wished to purchase, they could do so. If the question of political influence or anything of that sort were wiped-out, he did not for a moment believe that Stretford would want to do what they were doing; they were afraid of this thing being used as a weapon against them.

Sir ELLIS GRIFFITH suggested that if they gave the Corporation the construction part of the Bill, allowed four or five years to pass, and then let them make another application in respect of the purchase—that would perhaps be a fair way.

The CHAIRMAN reminded Sir Ellis of Mr. Clode's suggestion.

A short adjournment then took place, to enable the parties to confer; but no agreement having been reached, it was decided that the Committee should adjourn until Friday.

Friday, April 29.

On the resumption of the proceedings,

Sir ELLIS GRIFFITH expressed his regret that he had not been able to accept the terms offered by the Corporation.

The Bill was, therefore, proceeded with.

Mr. *W. A. Nicholls* (the Chairman of the Stretford Gas Company) gave evidence as to the financial position of the Company. The share capital was £260,000; and the loan capital £68,750. At the present time there was a large overdraft on the bank. After pointing out the difficulty they had had, as a small concern, in raising money, witness confirmed the previous evidence with regard to the agreement with the Corporation. It was in the interests of the consumers that the transfer should go forward under the terms of the agreement. As to the reasonableness of the price, he said he had wanted more, but had agreed to accept the present figure. It was his positive conviction that he could not supply gas at the same price as Manchester would be able to when they got their new works, and was more certain that the local authorities could not supply even at the Company's own price. The cancellation of the agreement would put the Company into a very difficult financial position.

Dealing with the question of the railway siding at the Stretford works, witness said that in 1897 an application was made to the Cheshire Lines Committee, but was refused. Two more applications were made—the last one in 1903. On these occasions the Cheshire Lines Committee made suggestions to them; but it was proved that, if the siding were provided, the cost of coal per ton would be more than if the coal were carted.

In cross-examination, Sir ELLIS GRIFFITH dealt with the fact that between 1910 and 1914 the price of gas in Stretford was lower than in Manchester. The reason was, said witness, that the renewals expenses during that time were heavier in proportion in Manchester than in Stretford, owing to there being new plant at the latter works. There were other matters, however, which contributed to this cause—such, for instance, as receipts being spent on the works, instead of taking the money from the capital account. As to Altrincham gas being cheaper than either Manchester or Stretford gas although a smaller undertaking, witness pointed out that all gas supplied at Altrincham was coal gas, whereas Stretford, as well as Manchester, had to supply a proportion of carburetted water gas. Again, meter-rents were not included in the price of gas. Dealing with the suggestion that the local authorities should purchase the Stretford Company's undertaking, witness said that, owing to the Company's financial position, the transfer should be carried through without delay.

In re-examination by Mr. CLODE, witness said that if an average of 25 years were taken, he was of opinion that the price of gas in Stretford would be found to be below that in Altrincham. Coming to the financial position of the Company, he said he would never have been in his present financial position but for the fact that the present negotiations for purchase were pending. If the Committee decided that the local authorities should have the opportunity of acquiring the undertaking subsequently, this did not concern the Company. His desire was that it should be taken over immediately.

In answer to Sir ELLIS GRIFFITH, it was stated that the borrowing powers were about £75,000—*i.e.*, 50 p.ct. of the paid-up capital.

Mr. *Brown* (a late member of the Stretford Urban District Council, and Chairman of the Council in 1917-18) gave evidence in support of the Bill. He said he was a resident in Stretford, and was of opinion that the Manchester scheme would be a very great improvement upon the present position, and that the district should take advantage of the offer.

Mr. *Arthur Collins*, the Birmingham City Treasurer, was then cross-examined by Sir ELLIS GRIFFITH on questions of finance. Sir Ellis referred to last year's working of the Manchester undertaking, which showed a deficit of £40,000, thus pointing to the necessity for raising the price of gas. Witness explained, however, that this deficit was not due to trading. An extra charge should have been provided for to meet a demand made upon the undertaking for a sum in relief of the rates; and a further sum had been spent for which a loan could have been authorized. The year's working, therefore, really showed a profit of £23,000. It was also estimated that there would be a deficit for the present year; but witness said the estimate included provision for everything that might be required for the undertaking. As a matter of fact, a great many of the things provided for would not be dealt with; so that the money would not be spent. As Sir Ellis pressed the point, however, that this would result in an increase in the price of gas to the consumers, including those in Stretford, if the Bill were passed, witness said that the margin was large enough to admit of the possible increase involved, and still leave a substantial advantage to be secured by the Stretford people.

Re-examined, witness said Sir Ellis had dealt with contingencies, and had ignored possibilities. If the transfer were delayed indefinitely while the local authorities were deciding to acquire the undertaking, the Company would be unable to carry on in the meantime. As to the question of a bulk supply, it was the wish of the local authorities to be masters in their own house; but if a bulk supply were taken from Manchester, they could not be from the financial point of view. He had never known a case in which an undertaking had been compelled to supply in bulk.

This concluded the case for the promoters, and evidence on behalf of the petitioners was proceeded with.

Sir *Thomas Robinson* (M.P. for Stretford, and a member of the Stretford District Council) dealt in detail with the parliamentary proceedings in connection with the transfer of the electricity undertaking to Stretford, and suggested an agreement involving a bulk supply from Manchester to the local authorities, who would be the distributing authorities in their own area. The suggestion had been made that the ratepayers would favour the present scheme; but he had not heard of it. They would give every possible help to the Corporation with regard to the construction part of the Bill; but they objected to the purchase part. If they received a supply of gas in bulk, and distributed it themselves, they would be in no sense middlemen, inasmuch as they themselves were the consumers, and they had no desire to make a profit. He suggested, also, that economy would be effected in the collection of accounts from consumers, as this could be done at the same time as the rates were collected.

Cross-examined by Mr. CLODE, who asked if there was any real objection to the Corporation's taking over the Company's undertaking temporarily, so that the local authorities could purchase it subsequently, witness said that municipal trading by the Manchester Corporation would be a dangerous precedent to establish.

The CHAIRMAN: How much time do you give them?

Mr. CLODE said he wanted to give them the very earliest opportunity.

In answer to further questions, witness said the local authorities did not wish to go to Manchester to buy the undertaking. He did not anticipate that they would get it more cheaply by negotiating with the Company direct; but there would be other expenses saved, such as stamp duties.

Mr. CLODE pointed out that, although so much importance was attached to stamp duties, the local authorities thought nothing of the expense involved in prolonging the present parliamentary proceedings.

Continuing, counsel asked why they were certain they could purchase the undertaking from the Company.

Witness said the Chairman of the Company had intimated to him that he did not care to whom it was sold.

Mr. CLODE said that the Company were not necessarily a willing seller, and referred to the conditions which obtained under the compulsory purchase clauses. If the Bill fell through, there would be no machinery for acquiring the Company.

Sir ELLIS GRIFFITH pointed out that parliamentary powers would be necessary in any case in order to form the joint board.

During further discussion, in which Mr. Clode reiterated his concessions, witness suggested that the Manchester Corporation were difficult people to deal with, and said he believed that if the Lord Mayor and himself discussed the matter alone, they would arrive at agreement in half-an-hour. At this,

Mr. CLODE suggested that further conversations should take place privately, with a view to arriving at an agreement. He had made concession after concession, but witness would not agree to anything.

The CHAIRMAN commented upon the uncompromising attitude of the witness; and, after further discussion, it was decided that an effort should be made to reach an agreement.

The Committee, therefore, adjourned.

Monday, May 2.

On the resumption of proceedings this morning,

Mr. CLODE, K.C., for the promoters, said that since the adjournment the petitioners had sent the promoters a clause which the latter thought carried out the terms of settlement which they offered. They accepted the clause in principle; but certain small drafting amendments would have to be made. The clause provided that, if the Urban and Rural District Councils opposing the Bill, or any two or more of them jointly introduced a Bill in the next session of Parliament—providing for the constitution of a Gas Board to purchase the undertaking from the Corporation, and requiring the Corporation to sell to them the whole of the undertaking of the Company—the Corporation shall not directly or indirectly oppose except for the purpose of securing the insertion of clauses to protect their interests. The Corporation should also offer all reasonable facilities for the inspection of the books; and, if such powers were granted, may contract with the Board to give them a supply of gas in bulk upon terms to be agreed. The Corporation, said Mr. Clode, wanted to do all that was necessary for the consumers; and provision would have to be made for the taking over by the Board of any additional costs incurred by the Corporation. The clauses providing for a uniform price of gas throughout the area, as well as prohibiting the application of gas revenue to the relief of the rates had also to be drafted.

The CHAIRMAN congratulated the parties upon having arrived at a reasonable compromise.

The clauses, as finally agreed, will be submitted to the Committee later on.

Clause 20 of the Bill, which gives power to make and maintain gasworks, includes the usual one-third provision with regard to residuals. To clause 39, which fixes the price at 5s. per 1000 c.ft., an addition has been made providing that within a year from the passing of the Act the Corporation shall apply to the Board of Trade for an Order to charge a maximum price per therm corresponding as nearly as may be to the maximum price authorized by this section, without any addition in respect of increases in the costs of the production and supply of gas which have occurred since June 30, 1914. As to testing the calorific value of

the gas, the prescribed testing-places are the four existing gas-works of the Corporation, and the Siretford Gas-Works; and testing apparatus is to be supplied similar to the apparatus prescribed by the Metropolitan Gas Referees for testing the calorific power of the gas supplied by the companies referred to in the London Gas Act, 1905. The calorific value of 450 B.Th.U. may be reduced or increased by the Board of Trade on the application of the Corporation or any body or person interested. Not more than one test is to be made on any one day, unless the calorific power is found to be below the standard, when a second test shall be made after an interval of not less than an hour; and the average of the two tests shall be deemed to be the calorific power of the gas on that day. The Corporation shall be liable to the following penalties if the calorific value of the gas on any one day is below the standard by more than 5 p.ct.: If the deficiency does not exceed 14 B.Th.U., a sum not exceeding £2; if the deficiency exceeds 14 B.Th.U., but does not exceed 28 B.Th.U., a sum not exceeding £5; if the deficiency exceeds 28 B.Th.U., then for each complete 28 B.Th.U., a sum not exceeding £10. The pressure is fixed at 2 inches; but in the original Bill it was 15-10ths.

The agreement between the Corporation and the Company, which is scheduled to the Bill, provides that the Corporation shall purchase the Company's undertaking—including lands, fixed and loose machinery, mains, pipes, stock, tools, instruments, &c.—the benefit of all agreements as to the sale and supply of gas and residuals, and all rights, powers, liberties, privileges, and authorities whatsoever of or to which the Company are entitled at law or in equity on the day of transfer; all moneys of the Company, including the reserve fund, cash in hand, cash at bankers, and all gas rents and charges which may be due or accruing due to the Company on the day of transfer; the benefit of all contracts, &c., entered into by the Company prior to the day of transfer in connection with the carrying on of the business of their undertaking, subject to the payment and performance of the respective rents or sums. The Corporation are to pay all debts and obligations owing or outstanding on the day of transfer, excepting the amount due to the shareholders of the Company in respect of their shares in the Company and any dividends due thereon, and shall indemnify the Company against same. The Company shall keep the undertaking in a good state and condition up to the day of transfer, but shall not enter into any contract after the date of the agreement (Feb. 8, 1921), involving an expenditure on capital account exceeding £100 without first obtaining the consent in writing of the Corporation. The staff of the Company are to be taken over by the Corporation; and if within twelve months after the transfer the Corporation decide to dismiss any of the officials, staff, or permanent employees of the Company who have entered into the service of the Corporation under this agreement on the ground that their services are no longer required, they shall be entitled to compensation under section 120 of the Local Government Act, 1888.

ROTHERHAM CORPORATION BILL.

This Bill last week came before Section A of the Local Legislation Committee of the House of Commons, presided over by Sir William Middlebrook. Clause 98 of the Bill, as originally deposited, fixed the maximum price of gas supplied by the corporation at 5s. per 1000 c.ft.; but this clause has since been struck out of the Bill. Clause 99 remains, which gives the corporation power to vary by agreement the price of gas according to the purposes for which it is supplied, provided the corporation shall not give any preferential price as between consumers taking a similar supply for the same purpose.

Clause 23A has been added to Part III. of the Bill. It deals with water, for the protection of the Bawtry and District Gas Company and the Maltby and Bramley Gas Company. It provides that seven days before commencing works authorized which would involve the alteration or stopping-up of the companies' apparatus, notice shall be given to the companies, together with particulars of the proposed works. If within seven days from the submission of such particulars the gas companies disapprove, such works shall not be commenced until the particulars, &c., have been agreed, or settled by arbitration. If the gas companies do not signify their approval or disapproval within seven days, they shall be deemed to have approved; and the companies' apparatus may be dealt with (at the cost of the corporation), but under the superintendence and to the reasonable satisfaction of the companies' engineers; and the reasonable expenses of such superintendence shall be paid by the corporation. If any interruption in the supply of gas, or loss of gas, is occasioned by any act or omission of the corporation, the corporation shall pay compensation to the companies, as agreed; or, failing agreement, the amount is to be settled by arbitration. In the event of differences arising between the corporation and the companies, these are to be settled by an arbitrator to be agreed between the parties, or, failing agreement, to be appointed on the application of either party by the President of the Institution of Civil Engineers; and the Arbitration Act, 1889, shall apply to the reference.

Fatality Caused by a Gas-Ring.—At Huddersfield last week, a verdict of "Accidental death from shock from burns; her clothing having been ignited by a gas ring," was returned in the case of Doris Whiting, a probationary nurse at the Kirkburton Joint Isolation Hospital. At the time of the accident she was on light duty, and her clothing caught fire from a gas-ring while she was making tea. She herself admitted that she had been careless. The gas-ring was declared by a juror to be in a dangerous place, and he recommended that it be removed to a safer position.

Finances at Morecambe.—In introducing the annual estimates at the Morecambe Town Council last week, Alderman Snowdon said the Street Lighting Committee required £3740, including £800 to go direct to the Gas Committee. The Electricity Committee had a deficiency of £2124; but the Gas Committee expected to have a profit of about £2000, as against £894 last year, which would go to the reserve fund. During the year, coal, wages, repairs, and renewals had cost £11,000 more than in the previous twelve months; but this expense was met by increased gas-rentals and better prices for residuals. This had been done without increasing the price of gas during the year.

LEGAL INTELLIGENCE.

CARDIFF PUBLIC LIGHTING CONTRACT.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, April 26.

(*Before Mr. Justice* RUSSELL.)

Cardiff Gas Light and Coke Company v. Cardiff Corporation.

This was an adjourned summons taken out under the Courts (Emergency Powers) Act, for the alteration of a contract for the supply of gas for public lighting.

Mr. ROMER, K.C., and Mr. ROBERTSON appeared for the Gas Company; Mr. CLAUSON, K.C., and Mr. SWORDS for the Corporation.

Mr. ROBERTSON said this was an application under the Courts (Emergency Powers) Acts, 1917 and 1919, asking that an agreement made between the Gas Company and the Corporation on Dec. 17, 1907, for the supply of gas for the public lighting of Cardiff, might be annulled or amended, owing to circumstances due to the late war, on the ground that it could not be carried out without causing serious hardship to the Company. The Act of 1919 provided that where, on an application by any party to a contract entered into before Jan. 1, 1907, the Court was satisfied that, owing to the prevention or restriction of, or delay in, the supply or delivery of materials, or the diversion or insufficiency of labour, or the shortage of shipping, or alteration of any trade conditions occasioned by the war, a contract could not be enforced according to its terms without serious hardship, the Court might, after considering all the circumstances of the case, and the position of all the parties to the contract, and any offer which may have been made by any party for a variation of the contract, suspend or annul the contract on such conditions (if any) as the Court might think fit. Under section 24 of the Gas-Works Clauses Act, 1871, the Company were bound to supply gas for public lamps at certain fixed prices, and which in case of difference were settled by arbitration. The agreement in question was arrived at when the Company's Bill was passing through Parliament: and it provided that gas should be supplied as from June 26, 1907, for public lighting at a price not exceeding 2s. 2d. per 1000 c.ft., or 7d. less than that charged to the public.

His LORDSHIP asked whether there was any obligation on the part of the Corporation to take gas from the Company.

Mr. ROBERTSON said he did not think there was. His contention was that the agreement inflicted serious hardship upon the Company, and, without going into the evidence, he might say it was undisputed that the cost price of gas to the Company was 3s. 10·5d. per 1000 c.ft., and the price charged to the general customers was 5s. 6d.; the resulting annual loss under the contract being £3161. His offer was to supply at 7d. less than the price charged to private consumers.

His LORDSHIP asked whether the consumption was fairly regular year by year.

Mr. ROBERTSON replied that it was. The jurisdiction of annulling or extending contracts was a new and special power; but fortunately there was some authority bearing upon the point—viz., that of the *North Metropolitan Electric Company v. Stoke Newington Corporation*, where the Court granted the relief asked for in the present case.

His LORDSHIP: Was your application made before or after that case was decided?

Mr. ROBERTSON: After.

His LORDSHIP: Your offer is 7d. less than the amount charged to private consumers?

Mr. ROBERTSON said that was the offer; but it was not accepted by the Corporation.

Mr. ROMER here took up the opening. He said the Company were incorporated under a Private Statute which was repealed in 1854, though the Company were continued by their incorporated name. From time to time Acts of Parliament had been passed extending their operation; but it would not be necessary to refer to any, except two sections of the Act of 1887 and the Act of 1906, which might have some bearing upon the point at issue. Section 31 of the Act of 1887 fixed the maximum price at 3s. 6d. per 1000 c.ft.; and by section 32 the Company were obliged to supply gas to the Local Board at the same rate as that charged to the Corporation. The Act of 1906, section 24, fixed the maximum rate of dividend which might be paid on the stock; and section 31 altered the maximum price per 1000 c.ft. within the City of Cardiff from 3s. 6d. to 3s. In 1901 an agreement was entered into between the Company and the Corporation for the maintenance of gas-lamps for public lighting, and for the supply of gas for this purpose at a certain price, which worked out at about 3s. per 1000 c.ft., or 6d. less than the amount charged to ordinary consumers. In the Parliamentary Session of 1906 a Bill was promoted, which was opposed by the Corporation, and as a result a compromise was arrived at on various points, including the price to be charged to the Corporation for gas; and the agreement of 1907 (which was the subject of the action) was entered into, fixing the price at 2s. 2d., or 7d. less than that charged to private consumers. This argument still regulated the rights of the parties. In 1917 nearly every gas company in the kingdom was suffering from financial loss by reason of the war. All of them had to fix maximum prices; and a great number (including the Cardiff Gas Company) presented Bills to Parliament, or were contemplating doing so for the purpose of getting some relief from their statutory obligations. The number of Bills being so large, a Committee was appointed by the House; and, as a result, the Board of Trade secured the passing of a Bill which became known as the Statutory Undertakings (Temporary Increase of Charges) Act, 1918. The Company's Bill, which was opposed by the Corporation, was, as a result of the new measure, not proceeded with; and in February, 1920, application was made by the Company to the Board of Trade under the Act, and a statement was put in showing that the increases in expenditure, &c., had resulted in the Company carrying on business at a loss, and that the reserve fund had had to be drawn upon to pay the dividends. The deficit worked out at £89,990, to meet which it was necessary to raise the price of gas by

1s. per 1000 c.ft., in order to pay a dividend of 3½ p.ct.; and an Order to this effect was made by the Board of Trade. Subsequently, a further application had to be made, owing to substantial increases having taken place in the cost of materials and labour, resulting in a deficit of £92,572; and an Order was made empowering the Company to increase the price by 1s. 6d. per 1000 c.ft. So that private consumers were now being charged 5s 6d. per 1000 c.ft., though the Board of Trade had no power to alter the agreement between the Company and the Corporation. After the Order of August, 1920, was made, it was found the increase was not sufficient for the Company to earn a dividend of 3½ p.ct., though it was paid out of reserve. The actual cost price to the Company of manufacturing gas was 3s. 10·5d. per 1000 c.ft.; and during the year the actual loss on supply to the Corporation was £3161. In addition, there was a loss of £395 on gas supplied to the District Council. The financial result to the Company for the year 1920 was a balance of net profit of £991 15s. available for dividend; and as the amount required was £23,158, there was a deficiency of over £22,000, which had to be taken from reserve. In 1920 another measure was passed, called the Gas Regulation Act, which empowered the Company to increase the price to private consumers to 6s. 5d. per 1000 c.ft. Whether this increase would meet the case, he was not sure, though his impression was that it would not be sufficient to enable the Company to pay the statutory dividend. In December, 1920, the Company deposited a new Bill, which had not yet come before a Committee of the House, for power to amend the charge under the agreement by making it 7d. for public lighting under the price charged to private consumers. But after the decision in the case of the North Metropolitan Electric Company, they considered they would be met with the objection in Committee that Parliament had already provided a remedy for any hardship, and accordingly the present summons was taken out. He read the affidavit of Mr. George Clarry (the Secretary and General Manager of the Company) in support of the application.

An affidavit of Mr. Brown (the Town Clerk), in opposition, was then read by Mr. CLAUSON.

His LORDSHIP said he had some doubt if he ought to consider the question of whether the Company earned sufficient to pay a dividend.

Mr. ROMER observed that it was essential the Company should pay a dividend, as from time to time they had to raise further capital, which could not be done if a dividend had not been paid in past years. Having regard to the evidence as to the state of affairs at the present time, he admitted that, unless the Court could see that there was a reasonable certainty of something occurring which would render interference unnecessary, the order asked for should be made.

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Mr. *George Clarry* was called, and stated that in 1911 the total cost of production per 1000 c.ft. of gas was 1s. 11·13d.; and the charge to the Corporation was 2s. They were content with a reasonable profit, and had been always willing to charge as near as possible cost price.

Mr. *R. J. Auckland*, Accountant and Assistant Secretary, produced a statement which he had made for the Board of Trade showing the cost of production and distribution of gas. For 1913 the cost per 1000 c.ft. was 21·81d., and in 1920 48·67d. The difference between his figures and those of Mr. Herring (for the Corporation) was due to the fact that Mr. Herring had not included rent for meters and cookers. His estimate of the cost of production for the year 1921 was 5s. 7·53d. per 1000 c.ft.

Mr. CLAUSON said the agreement of 1900 between the Company and the Corporation was that gas should be supplied at a figure which was either less than, or to a very trifling extent above, cost price; and he suggested that they should be charged a certain percentage—say, 20 p.ct.—less than the charge to private consumers.

Mr. ROMER pointed out that the price to private consumers depended upon the cost of production and dividend. As a counter proposition, he suggested that the charge be based on cost price.

Mr. CLAUSON objected, as this would be calculated on borrowed money; and the more the Company financed themselves on borrowed capital, the worse it would be for the Corporation. The result of annulling the contract would be to cause an injustice to the Corporation, as it was evident that the agreement between the parties, that gas should be supplied to the Corporation at a figure just about cost price, must have been given in exchange for something. What was it that was given up? It was the opposition by the Corporation to the Company's Bill in 1906; and in the circumstances, the Court should not exercise its discretion and annul an agreement which had been made for good consideration. He contended that the matter should be left to Parliament to deal with the case as a whole when they considered the Company's Bill.

Mr. ROMER denied that any injustice would be done to the defendants by the Court exercising its discretion, except in the sense that the Act of Parliament was unjust. The truth was Parliament realized that, having regard to the extraordinary change of conditions brought about by the war, it was just that contracts of this kind should be annulled. These applications never came before the Court, except in cases where the respondent was entitled to a benefit under a contract; and Parliament had laid it down that the Court, in exercising its discretion, should take into consideration any offer made. It had been urged that the Corporation gave up something when they obtained the contract for the supply of gas at 2s. 2d.; and it was unjust that they should be deprived of this contract. But the answer was that Parliament had provided that the Court should, in exercising its discretion, consider any offer so as to minimize the hardship. The offer of the Company was to supply gas at 7d. per 1000 c.ft. less than the price paid by private consumers. Had this offer been made in 1906, it would probably have been accepted; but as it was not accepted, the Company asked that the contract should be annulled, and that the price should be fixed by arbitration. The Court could not refuse to annul the contract on the ground that a hardship would be done to the respondent, when he had refused a reasonable offer. A further point had been made that although the Company suffered a loss, the hardship was not great, as under the 1907 agreement a loss was contemplated. He denied this entirely; the price was fixed at the time so as to avoid a loss. Then it was said the Court should leave Parliament to settle the question when they considered the Company's Bill; and but for the fact that a Bill had been promoted, this contention must fail, as it could not seriously be urged that, if a Bill had not been presented, a company was bound, in the event of a dispute of this kind arising, to promote a Bill in Parliament.

His LORDSHIP, at the conclusion of the arguments, postponed the judgment for a few days, in order to enable the parties to consider the fresh proposals which had been made.

At the rising of the Court on the 29th ult., Mr. ROMER informed His Lordship that it would not be necessary to deliver judgment, as the parties had come to a settlement. There would be an order staying all further proceedings on terms arranged between the parties, with liberty to apply in case of necessity.

Gas-Fitters' Union Employment Rules.

At the Birmingham Police Court, last Thursday, before Lord Ilkeston (Stipendiary), five members of the National Gas-Fitters' and Allied Workers' Trade Union claimed damages for wrongful dismissal by the Birmingham Small Arms Company, Ltd., without proper notice, on or about Jan. 14, or alternately, for a week's money in lieu of notice. Mr. Norris, for the claimants, said they were dismissed without receiving notice. The Union from time to time published copies of their working rules; and he would call the Secretary to show that copies of these rules were handed to a representative of the Company. Under one of them, unless a workman was guilty of such misconduct as to justify instant dismissal, he should be entitled to receive, or should give, a week's notice to terminate his employment. This, Mr. Norris said, was the general practice. Mr. Willison, for the Company, pointed out that the claimants did not suggest there was any special contract between themselves and the Company to give them a week's notice. There was nothing to suggest that a copy of the rules of the Union was handed to the Secretary or Chairman, or that the Company ever agreed to anything of the kind. The Stipendiary did not consider there was a binding contract, and made no order. If the men liked to make contracts with the employers, they could do so; but just to go up to somebody and give him rules, and expect the Company to accept liability, did not constitute an agreement, and did not properly bring the matter before the employer.

REGISTER OF PATENTS.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official List" for April 27.]

Nos. 11,137 to 11,794.

ACCIOLY, F. DE M.—"Manufacture of an alcoholic liquid (synthetic) gas for use as a combustible." No. 11,419.

ADLER, N.—"Gasometer." No. 11,584

BECKER, H. G.—"Gas-blowpipes." No. 11,762.

CARRATT, A. J.—"Gas-producers." No. 11,393

CHANDLER, D.—"Gas-fired metallurgical furnaces." No. 11,699.

CHAUDIÈRE, E. F.—"Furnaces, gas-producers, &c." No. 11,321.

CHRISTIE, J. C.—"Apparatus for gas firing of boilers, furnaces, ovens, &c." No. 11,500.

DAVIE, J. J.—"Superheating gas chambers for radiating stoves, rooms, &c., for use with producer gas, &c." No. 11,509.

DAVIDSON, T. M.—"Retorts." No. 11,222.

FAIRWEATHER, C. & G. A.—"Recording-mechanism for gas calorimeters, &c." No. 11,726.

GREENWOOD, T. W.—"Method of lighting and ventilating rooms." No. 11,525.

HARTMANN, C.—See Adler. No. 11,584.

HAWTHORN, J. H.—"Gas-stoves for heating." No. 11,753.

HINDLEY, H.—"Brick for furnaces, fires, &c." No. 11,741.

HOGG, W.—"Method of making metallic pipe-joints." No. 11,643.

JACKSON, W. E.—"Incandescent gas-burners." No. 11,158.

JOHNSON, J. Y.—"Apparatus for discharging gas-retorts." No. 11,454.

KEITH AND BLACKMAN COMPANY, LTD.—"Liquid fuel and process for production thereof." No. 11,444.

LOW-TEMPERATURE CARBONIZATION, LTD.—"Retorts." No. 11,222.

RUTHERFORD, R.—"Automatic gas cut-off and economizer." No. 11,627.

SMITH, J.—See Jackson. No. 11,158.

SOC. DITE ENTREPRISES ET MATÉRIEL.—See Johnson. No. 11,454.

SOUTH METROPOLITAN GAS COMPANY.—See Chandler. No. 11,699.

SVENSKA AKTIEBOLAGET MONO.—"Gas-analyzing apparatus." No. 11,359.

VAUDT, W.—See Adler. No. 11,584.

WEST, J., AND WEST'S GAS IMPROVEMENT COMPANY, LTD.—"Charging means for retorts for the distillation of carbonaceous materials." No. 11,191.

WHATMOUGH, W. A.—See Keith. No. 11,444.

WILD, W.—See West. No. 11,191.

APPLICATION FOR RESTORATION OF LAPSED PATENT.

Notice is given that FREDERICK HENRY TWEED has made application for the restoration of the patent granted to him for "Improvements in pipe connections"—No. 16,722 of 1913, dated July 21.

Chelmsford Pipe Contract.—With reference to the statement on p. 218 of last week's "JOURNAL," to the effect that the Chelmsford Town Council had accepted a Belgian tender for cast iron gas-mains, Mr. A. G. Cloake points out that this is erroneous—the contract having been placed with La Société Métallurgique d'Aubrives et Villerupt, of Ardennes, France.

MISCELLANEOUS NEWS.

LIMITATION OF INERTS.

BOARD OF TRADE COMMITTEE SITTINGS.

Wednesday, April 27.

The Committee met to-day, when evidence was given by Sir Dugald Clerk, F.R.S. In the course of a statement he placed before the Committee, Sir Dugald Clerk said :

A previous witness has referred to my presidential address to the Institution of Gas Engineers in June last, as advocating a low percentage of inerts in coal gas. In this, he is mistaken. I advocated the necessity of allowing a high percentage, in order to increase the thermal and economic production of coal gas for distribution, where a greatly improved efficiency was obtained by partial or complete internal heating. Other previous witnesses have advocated the allowance of a high inert percentage in ordinary gas production, by external heating and destructive distillation. As they speak from wide experience in the older processes of gas production, within their own experience as engineers and managers of large gas-works, I wish to express my agreement with their broad conclusions. But it is unnecessary for me to discuss that side of the question under consideration. I shall devote my evidence to discussing the advantages of internal heating as shown by producer gas plant now in extensive use throughout the United Kingdom for the production of motive power by gas-engines.

In my opinion, a gas suitable for producing heat, motive power, and light can be produced at the high thermal efficiency of 75 p.ct., if sufficient latitude be allowed in the matter of inerts' percentage. The average efficiency of gas production and distribution in the country at present is approximately 45 p.ct. The saving of coal per annum is obviously very great if such processes be introduced. In ordinary gas producers for motive power, thermal efficiencies as high as 85 p.ct. have been found in ordinary practice ; but the analysis by volume is roughly 40 p.ct. of combustible gases and 60 p.ct. of inert gases, while the gross calorific value is 140 B.Th.U. per cubic foot. Such a gas is suitable for few purposes other than gas-engine supply. For general purposes—heating, furnace work, incandescent gas-mantles, and gas-fires—a sufficient flame temperature cannot be attained under 300 B.Th.U. per cubic foot. Indeed, it will generally be desirable for some years to come to deliver gas about 350 B.Th.U. The many new processes for increasing the amount of total heat transferred from the coal to the gasholder to 50 p.ct. instead of 25 p.ct. and 75 p.ct. instead of 45 p.ct. thermal efficiency by means of processes involving increased or even complete gasification of the fuel, all require considerable liberty as to inerts. To get high proportional gasification and high thermal efficiency together, it would be necessary to allow at least 30 p.ct. of inerts. This proportion would give a gas of sufficiently high flame temperature to be applicable to the three great uses of gas for heating, lighting, and motive power at a minimum cost per therm. I am no advocate of any unnecessary proportion of inert gases, but only of such proportions as to permit of a maximum possible thermal and economic efficiency such as would be possible under the new legal provisions if liberty be not restricted by too rigid conditions. A cheap unit at a generally useful flame temperature will greatly increase the utility of gas supply to the public, and extend the consumption of gas for domestic and industrial purposes.

In answer to the Chairman,

Sir Dugald Clerk said that he was dealing with the efficiency of production of the gas rather than the effect of inerts in use for such purposes as lighting ; and from the point of view of economy of production, it would be better to have no limit at all on the percentage of inerts. At the same time, it would be very unexpected for him to find that a limit of more than 30 p.ct., as he had suggested, would be required. He had pointed out on previous occasions that it did not matter whether oxygen was added during production or after the gas was in the holder. It would have no effect on the flame temperature. The point was that in providing a gas for public and general use, there must not only be a cheap therm, but it must be a gas useful for the internal combustion engine. His experience of internal combustion engines was very large, and he had been concerned in the manufacture of one million H.P. of producers for them. Such a producer gas would contain 60 p.ct. of inerts ; and in a gas for such a purpose it did not matter whether the calorific value of the gas was high or low. With producer gas the calorific value was about 240 to 260 B.Th.U., and the flame temperature was rather low—about 1300° or 1400° C. But by mixing with it some 540 B.Th.U. gas, it was possible to get a flame temperature approaching 2000° C. This was beyond the flame temperature required for efficiently incandescing a mantle. Nor was it required, except for certain special purposes—for furnace work, where it was desirable to get the highest possible flame temperature. It was in this respect that the electric furnace had advantages, because in the electric arc furnace it was possible to get a temperature of from 2500° to 3000° C., which enabled things to be melted which could not be melted in other ways. For lighting purposes, however, with a temperature of about 1600° C. as the maximum for adjustment, a gas would be obtainable which could be efficiently burned. He did not wish to go into the question of gas production by means of vertical or horizontal retorts because his particular experience did not lie in this direction. He was not one of those who advocated an indefinite percentage of inerts. There was a small school which seemed to think that inerts were a benefit all round ; but he did not accept this view. Indeed, in some cases, the less the inerts the higher the flame temperature which could be obtained, but not very much. It was, in fact, astonishing how little effect on flame temperature the percentage of inerts had, within certain limits. The consumer was not prejudiced at all so long as the flame temperature was about 1500° C. If some mean between producer gas efficiency and coal gas efficiency in production was obtained, he foresaw a great future for the gas industry. Efficiencies should be obtainable of 75 p.ct., and even possibly higher ; and it would be a great pity for any such improvement to be blocked. The prospects were those of almost doubling the present efficiency, and the importance of this would be appreciated when it was realized that coal must be scarcer and dearer in time, and it was our duty to economize coal as much as possible. Apart from this, such a process would be economical to operate, even allowing for the higher distribution cost. Probably for a considerable time to come the calorific value of the gas supplied would not be less than 400 B.Th.U. ; but even with this there would be a substantial advantage. It was for these reasons that he advocated the industry's being left free to develop the process of internal heating which he had outlined in his presidential address to the Institution of Gas Engineers last year. Prof. Cobb had suggested the use of oxygen ; but at present this was not practicable, although later on no doubt it would be. So that what he was pleading for was that the industry should not be tied-up from the experimental point of view by a great limitation of inerts, and his idea from the producer gas point of view was that 30 p.ct. would be a reasonable figure. When the matter was gone into it was extraordinary how little the calorific value per cubic foot of a gas determined the flame temperature. He had dealt with this in 1912, in the second volume of his book, "The Gas-Engine," and had given a table showing how the heat units in the actual mixture burned—varying with the calorific value of the gas. The addition of 4 p.ct. of inerts to a 500 B.Th.U. gas, resulted in a drop in the heat units from 83·3 to 82·8.

The Chairman : And is that slight drop due entirely to the heat necessary to heat-up the 4 p.ct. of inerts ?—Yes, it is nothing else.

Answering a question, as to leaving the industry completely free of any limitation, as had been suggested by so many witnesses,

Sir Dugald Clerk said he did not think in such a case there was any fear of an undue proportion of inerts being sent out in the gas, because the distribution question came in ; and on this point he fully agreed with Mr. Goulden's evidence. He certainly thought that it would be reasonable to give the industry a chance to do the best it could before imposing any limit. He would not advocate any limitation which would interfere with experiment. The huge gas industry had developed enormously, and had been very beneficial ; but the development had taken place under very disadvantageous conditions because it had been tied by parliamentary control. The Act of 1920, he understood, had been passed to repeal these conditions ; and as long as the gas industry gave the cheapest possible therms, and a gas which had the most efficient flame temperature, he considered the public was amply protected.

The Chairman pointed out that under the Act there is no provision for flame temperature. but he gathered from Sir Dugald's evidence that the difference in flame temperature, even with 30 p.ct. of inerts, was so little that it would not be a serious matter.

Sir Dugald Clerk said this was so, because if a gas was sent out that could not be usefully burned, it would mean ruin to the company very quickly. The companies all the time were trying to give the highest efficiency, and the highest flame temperature, whether it was in the Act or not.

In answer to Mr. Butterfield,

Sir Dugald Clerk said that his 30 p.ct. of inerts was air-free inerts. Prof. Cobb had proved up to the hilt that oxygen did not act as an inert until it was present in excess. He himself had many years ago proved conclusively that the flame temperature was reduced by excess of oxygen, but this was not an economical position from the gas company's point of view. If a limit of 30 p.ct. of air-free inerts was imposed, he did not think any of the present gases in the country would be excluded.

Mr. Butterfield said that in the analyses put forward by the railway companies there appeared to be one or two instances in which the 30 p.ct. limit was exceeded. Rotherham, he believed, showed 37·9 p.ct. and 0·3 p.ct. of oxygen. Did Sir Dugald think that in normal times there would be any need to distribute such a gas ?

Sir Dugald Clerk said he did not ; but even so, if the flame temperature was kept up, the consumer would not be at a disadvantage. He could not say definitely, without seeing the analysis of the gas, that this would be the case in the instance referred to. If a very large proportion of the 30 p.ct. was carbonic acid, it would be serious ; but this was hardly possible. Generally speaking, however, he did not think it would interfere with the development of the gas industry if a limit of 30 p.ct. of inerts were imposed. If any gas undertaking was working with more than 30 p.ct., there would be all the time a desire to get the improvement which a lower percentage involved, owing to the question of distribution. After repeating the figures of efficiency of the three methods dealt with in his presidential address to the Institution of Gas Engineers last year, Sir Dugald (in answer to further questions by the Committee) pointed out how the proportion of coke would be reduced with a complete gasification system. At the present moment, there happened to be a very large demand for coke ; but in the ordinary course of events it would be better to reduce the quantity of coke, as would be the case with a complete gasification process, because of the difficulty of disposing of it ; and the result of this would also be a cheaper therm. A combined distillation and water-gas plant which he had in mind was bound to succeed in the end ; and he anticipated an efficiency up to 80 p.ct. Such a system would give a gas of just under 300 B.Th.U. With an efficiency of 67 p.ct., with a coal and water gas combination, the calorific value would be about 350 B.Th.U., although it was difficult to put a definite figure upon it. This, however, was the direction in which things were tending.

Asked as to the effect on transmission of altering the density of the gas, Sir Dugald said he had not gone into the question, but he could quite appreciate that it would be one of the leading difficulties. He could not, however, speak from personal experience of the transmission problem ; but even from this point of view there was little doubt that gas managers in their own interests would keep the inerts as low as possible.

The Committee then adjourned until May 11.

A meeting of shareholders of the Gomersal Gas Company last week passed a resolution confirming the transfer of the undertaking to the Spenborough District Council, on terms previously published.

GAS REGULATION ACT APPLICATIONS.

The following further notices have appeared in the "London Gazette" regarding applications by gas undertakings to the Board of Trade for Orders under the Gas Regulation Act.

SPECIAL ORDER UNDER SECTION 10.

Hayling Island Gas Company, Ltd.

The Company are applying for an Order to enable them to extend the area of their works, and to construct on the land a new holder, workshops, and buildings.

DECLARATION OF CALORIFIC POWER.

The following Company, having obtained an Order, has intimated the calorific power of the gas it intends to supply.

Tottenham District Light, Heat, and Power Company.—450 B.Th.U. (April 30).

GAS REGULATION ACT ORDERS.

There have been received from the Director of Gas Administration, Board of Trade, copies of the following further Orders made under section 1 of the Gas Regulation Act. The parts applying specially to the Companies named, and the date of coming into operation, are noted.

Barnard Castle Gas Company.

As from the declared date, the maximum prices in respect of gas supplied by the undertakers shall be 17·6d. per therm in the parishes of Barnard Castle and Stratforth, and 19 6d. per therm in other parishes or places within the limits of supply of the undertakers.

The undertakers may demand in respect of gas supplied through a prepayment meter a not greater charge than in respect of gas supplied to private consumers within their limits of supply through any other kind of meter or by any other method of supply.

(*a*) The charge for the hire of any prepayment meter and fittings to be used therewith shall be a sum of money calculated according to the number of therms supplied. The maximum rate of charge shall be for a prepayment meter and fittings (including a cooking stove) 2·4d. per therm; for a prepayment meter and fittings (not including a cooking stove) 2d. per therm.

(*b*) The charge for the hire of a prepayment meter, without fittings, shall be either a sum of money calculated according to the number of therms supplied (when the maximum rate of charge shall be 1·2d. per therm) or at the rate of 10 p.ct. per annum on the cost of the meter, whichever shall be the higher.

(*c*) The said charges shall include the providing, letting, fixing, repairing, and maintenance of the meter and fittings or of the meter (as the case may be), and the cost of collection and other costs incurred by the undertakers in connection therewith. [April 23.]

City of Chichester Gas Company.

As from the declared date the maximum price in respect of gas supplied by the undertakers shall be 22·4d. per therm; and the sum of 1·2d. per therm shall be substituted for the sum of 6d. per 1000 c.ft. mentioned in section 5 of the Chichester Gas Act, 1911. (April 29.)

Newcastle-upon-Tyne and Gateshead Gas Company.

After the declared date the standard price in respect of gas supplied by the undertakers shall be 14·4d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-four-fifths.

After the declared date,

(*a*) The maximum price in respect of gas supplied by the undertakers shall be 15·8d. per therm in respect of gas supplied within the limits of the city of Newcastle-upon-Tyne and the borough of Gateshead, and 17·4d. per therm in respect of gas supplied without the limits of the city and borough;

(*b*) The words "two thousand therms" shall be substituted for the words "four hundred thousand cubic feet" wherever they occur in section 31 of the Newcastle-upon-Tyne and Gateshead Gas Act, 1901. [April 27.]

Willenhall Gas Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 13·6d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by five-and-a-half. (April 29.)

ST. ALBANS GAS COMPANY'S ORDER.

An Agreement with the County Council.

The Parliamentary Committee of the Hertfordshire County Council report that the application of the St. Albans Gas Company, under section 1 of the Gas Regulation Act, to enable the Company to modify their existing statutory charges by substituting for the standard price per 1000 c.ft. a standard price per therm of 1s. 5½d. within the city of St. Albans or within one mile of the Town Hall of the city, with an additional 1½d. per therm for elsewhere in the Company's limits, came before the Board of Trade recently. In the meantime, however, negotiations took place between the County Council, the St. Albans City Council, and the Company, with the result that the following terms were agreed upon, and that it was not necessary for the County Council to appear before the Board of Trade.

(1) The maximum standard price to be 1s. 5·2d. per therm within the city of St. Albans and elsewhere within the Company's limits.

(2) The Company to abandon the differential charge of 1½d. per therm proposed for the outer districts.

(3) Deferred repairs to be carried out by the Company within the years 1921 and 1922.

(4) The Company to undertake not to pay a dividend on ordinary stock at a rate exceeding 5¾ p.ct. in respect of the year 1921, and 6 p.ct. in respect of the year 1922.

(5) After providing for the dividend and interest on the borrowed capital, the balance of profit in either of those years to be carried forward to profit and loss shall not exceed £500.

(6) Anything in excess to be applied in the reduction in the price of gas.

(7) The additional 4d. per therm for prepayment supplies is only to be charged where houses are fitted with lighting and/or cooking appliances at the cost of the Company.

(8) Where a slot meter only is supplied by the Company, the additional charge to be limited to 2d. per therm.

(9) It is to be understood that the Company shall still be subject to such provisions as will provide for the dividends payable to shareholders being dependent on the price charged for the gas along the lines of the provisions laid down in "The St. Albans Gas Act, 1899"—*i.e.*, that as the price of gas to the consumer is increased, so the dividends to the shareholders shall be decreased.

(10) The minimum standard quality not to be below 450 B.Th.U. unless with approval of the Board of Trade and the St. Albans Corporation.

(11) The expression the City of St. Albans to mean the city as it now exists or may hereafter be extended.

As, however, the Board of Trade refuse to incorporate the terms in the Order made by them, it will be necessary for an agreement to be entered into between the City Council of St. Albans, the Hertfordshire County Council, and the Company, setting out the terms.

MANCHESTER GAS BUDGET.

The Manchester Gas Committee met on Monday of last week for the purpose of considering the financial report on the past year's working and the estimates for the current year.

It was announced that the total income for the year was £1,776,054, which included receipts from the sale of gas, £1,179,315; coke, £434,447; tar, £144,343; and ammonia sulphate (and sundry receipts), £17,949. The expenditure, which included a supplementary provision for the renewal of plant, amounted to £1,625,246, leaving a gross profit for the year of £150,808. Commitments to the extent of £174,617, however, had to be met; and after the appropriation of the gross profit there remained a deficit of £23,809 to be carried forward to next year. The £174,617 on account of commitments was made up as follows: Interest on loans, &c., £50,761; statutory sinking fund, £59,732; final allocation in aid of rates, £32,473; cost of citizens' poll on Parliamentary Bill, £4058; capital expenditure, to be met out of revenue, £27,593. The capital outlay of the undertaking, it was pointed out, now stands at £3,652,165, and the net outstanding loan debt at £1,155,670, or 33·64 p.ct. on the outlay. The renewals fund amounts to £143,246; the expenditure on renewals during the year having been £114,962.

The gas sales for the year totalled 5750 million c.ft., an increase of 2·5 p.ct. The quantity of coal, &c., carbonized was 489,567 tons, an increase of 14,438 tons. Owing to the general trade depression, the sale of residuals suffered severely during the latter part of the year. An increase of 45,437 million c.ft. (1·6 p.ct.) is indicated in the day consumption of gas, and of 66,728 million c.ft. (2·07 p.ct.) in the night-time consumption. The number of consumers using ordinary meters was 116,737, and automatic meters 96,100.

Owing to the unsettled trade conditions, the Committee find it difficult to forecast the financial results for the coming year; and the revision of prices has been deferred until the final accounts have been audited. The figures adopted by them show an estimated total income of £1 721,000, compared with £1,776,054 for last year, a decrease of £55,056. An increase of £95,685 is estimated in the income from gas receipts, and a decrease of £150,739 from residuals receipts. The estimated expenditure is £1,673,316. With £68,000 for interest on loans, £73,751 for the statutory sinking fund, and £15,000 for capital expenditure, to be met out of revenue, a total of £1,830,067 is arrived at, which represents a balance of £109,067 in excess of income. To this amount last year's deficit of £23,809 has to be added; and after appropriating the balance of the reserve fund, it is calculated that, with gas at the present price, there will be a net deficit for the year of £94,449.

LANCASTER GAS-WORKS DEVELOPMENT.

There was a municipal inspection of the Lancaster Corporation Gas-Works last Wednesday, under the direction of Mr. G. Dixon (the Engineer), Mr. Haines (the Works Superintendent), and Councillor Till (the Chairman of the Gas Committee). The Chairman and Mr. Dixon provided afternoon tea; and at an informal gathering some particulars were given respecting the works and future development.

Mr. Dixon said there was sufficient plant to make 1,500,000 c.ft. of gas per 24 hours—coal gas, 1,100,000 c.ft.; water gas, 400,000 c.ft. The maximum output of gas on any day last year was 1,200,000 c.ft.,

so that there was still plant available for a 25 p.ct. increase in consumption. He estimated this would meet the normal needs of the town for a further five years, after which there must be fairly big extensions. The horizontal retorts and mechanical stoking machinery were modern, and in good order; but the retort-house was exceedingly old, and the roof would shortly require renewing. The water-gas plant was modern, and in good order. Of the two gasholders, one was erected in 1890, and the other in 1912. The former required extensive repairs; but the latter was in very good condition. The new electrical apparatus put in last year was highly satisfactory. The plant on the whole was efficient, as was shown by the exceedingly low cost of gas production. As to the distribution plant and mains, this side of the undertaking was inadequate, and had not received sufficient attention in the past. The trunk mains had been improved since the new high-pressure boosting main was completed.

Dealing with finance, he mentioned that the total debt on the undertaking was £14,616; and interest and redemption cost 5½d. per 1000 c.ft. sold—a figure which was lower than the average. Thus they were in a favourable position. Sketching the future policy of the Committee, he said the reserve fund stood at £18,000; and he estimated they would have to expend £22,000 within the next few years. The reserve fund would have to be considerably increased to meet this cost, and should be the first call upon the profits of the undertaking each year. After this came the important question of the extension of the works to meet the increased output. He hoped, by carefully nursing the existing plant, to delay this work until the present loans fall in. If this policy was adhered to, the extensions would be carried out without increasing the capital; and the undertaking would be one of the best in the country.

In conclusion, he explained that the new method of charging for gas on its thermal or heating value was not a scheme for allowing authorities to charge more for gas. It really safeguarded consumers, who would find it to be thoroughly satisfactory to them.

EXAMINATIONS IN GAS ENGINEERING.

City and Guilds of London Question Papers.

The following were the questions put by the Examiner, Mr. Samuel Tagg, of Preston, to candidates in the examinations in "Gas Engineering" which were held last Saturday week, under the auspices of the City and Guilds of London Institute. In each grade only eight questions were to be attempted. The maximum number of marks obtainable is appended to the different questions.

GRADE I.

1. What are the principles underlying the construction of a regenerative setting of horizontal retorts? (45.)
2. Give a cross-sectional sketch of a hydraulic main, showing gas and tar connections. (40.)
3. What conditions are responsible for the stoppage of ascension pipes? (35.)
4. Describe the construction of any type of plant for the manufacture of water gas with which you are familiar. (45.)
5. Describe the arrangement of plant for the complete condensation of tar and liquor. (40.)
6. Describe the construction and the method of working of purifiers for the removal of sulphuretted hydrogen. (45.)
7. Give a description of the apparatus required and the method employed for the determination of the calorific value of gas. (35.)
8. Describe with the aid of sketches the construction of a station governor. (35.)
9. Discuss the relative merits of dry and wet gas-meters. (35.)
10. Describe the construction of an inverted gas-burner, and state why higher efficiencies can be obtained by increasing the pressure of gas. (35.)

FINAL.

1. Give a cross-sectional sketch of regenerative setting of horizontal retorts, not necessarily to scale, but with the principal dimensions figured, and any explanatory notes that may be required. (45.)
2. Describe in detail the operation of heating up a bed of vertical retorts from cold, and the method of regulating the heat while in use. (40.)
3. Describe the physical and chemical changes occurring during the process of carbonizing a bituminous coal in horizontal retorts at high temperatures, giving the composition of the products evolved at successive intervals during the charge. (45.)
4. Give a description of a machine for charging horizontal retorts, and state the likely causes of a breakdown and the method of dealing therewith. (40.)
5. What conditions are essential for the efficient working of a carburetted water-gas plant? Give the steam and air blast pressures required and the fuel and oil consumptions in relation to the calorific value and the volume of gas made. (40.)
6. Describe the method of removing sulphuretted hydrogen from crude gas by means of oxide of iron, stating the amount usually present at the inlet and outlet of each purifier in the series. Give the chemical reactions involved in purification and in the revivification of the oxide, the percentage of free sulphur present after successive foulings, and the volume of gas purified in relation to the weight of the oxide used. (40.)
7. Describe a method of manufacturing neutral sulphate of ammonia. (35.)
8. Give a description of the apparatus required and the method employed for the determination of the inert constituents of town's gas. (35.)
9. What type of plant or combinations of plant would you recommend for the production of gas of (*a*) 425 B.Th.U. gross and (*b*) 500 B.Th.U. gross, having regard to the working costs and values of raw materials and residuals current during the last year? Give the reasons for your selection. (40.)
10. Discuss the relative advantages of distributing town's gas of (*a*) 425 B.Th.U. gross and (*b*) 500 B.Th.U. gross at the same price per therm. Under the above conditions, which quality would be preferred and for what reasons, by consumers of gas for; (*a*) Power purposes, (*b*) lighting, (*c*) heating, (*d*) cooking? (40.)

COKE AND BYE-PRODUCTS EXAMINATION.

The City and Guilds of London Institute Final Examination in Coke and Bye-Product Manufacture was held last Wednesday; the Examiner being Mr. D. V. Hollingworth. The following were the questions put, and the marks obtainable.

1. Give in full the specification of quality under which motor benzole is now being distributed, and describe briefly the tests which would have to be carried out to demonstrate that a sample of spirit would conform to all the requirements of the specification. (35 marks.)
2. Describe fully, giving sketches of the plant employed, the method of manufacture of any *one* of the following: (*a*) Pure xylene, (*b*) pure naphthalene, (*c*) neutral sulphate of ammonia, (*d*) commercial muriate of ammonia. (35.)
3. Write a full account of the method of preparing coal for coking, making reference to all essential operations. Give the composition of the coal before and after treatment, and sketch any apparatus in common use for removing surplus water from the washed coal. (40.)
4. Give an account of a process recently described in the Technical Press for the recovery from coke-oven gases of ethylene and its conversion into alcohol. (35.)
5. Draw, approximately to scale, half-length longitudinal views of a vertical-flued regenerative coke-oven, showing the construction of the regenerators, the heating flues, and the sole flues. (40.)
6. Make a simple outline drawing showing how a plant for the distillation of 200 tons of coke-oven tar per week should be laid out. Draw up a schedule giving the principal dimensions of all the plant and storage vessels required, and give an account of the nature and amount of the products which would be obtained. (40.)
7. Describe, with the aid of sketches, the construction, working, and methods of controlling any two dissimilar types of gas-exhausters. (35.)
8. State what you know of the composition, method of manufacture, and properties of a high-grade refractory material suitable for the construction of coke-oven walls. What is meant by the porosity of such material, and how is it determined? Give a sketch of the apparatus employed for the purpose. (40.)
9. Express, in terms of shillings per ton of dry coke made, the cost of carbonizing (labour only) on any plant with which you are acquainted. Give full particulars to show how you have arrived at your answer. (35.)
10. Assuming that spare coke-oven gas is to be supplied for public service, describe fully the nature and working of the additional plant that you would require for the purpose. What precautions would have to be taken during carbonization and subsequent processes to ensure that the supply conforms to all the customary requirements for a public service in respect of purity and calorific value? (40.)

TRADE NOTES.

[For "Journal" Advertisers.]

New Meter Factory in London.

Messrs. Alder & Mackay, Ltd., announce that they have now opened a factory in London, at Cricklewood Meter Works, Broadway, N.W. 2. By means of these works (where a good stock of new meters of all sizes is held) immediate deliveries can be given all round the South of England by motor wagon. At the same time, advantage can be taken of the firm's wagon for the collecting and repairing of meters in London.

New Gas Show-Rooms at Coventry.

Designs recently submitted by the Nautilus Company (associated with the Davis Gas-Stove Company, Ltd.) for new and extensive gas show-rooms have been approved by the Coventry City Council, who have instructed the Nautilus Company to carry out the work entailed without delay.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *May 2.*

There is a certain amount of inquiry for pitch for next season; but prices are still very unsteady, and sellers' and buyers' ideas of values are not yet reconciled. Tar for road work continues in good demand. Creosote remains a quiet market; sellers' ideas of price being about 9½d. per gallon in bulk. Solvent naphtha is quoted at about 2s. 6d. to 2s. 9d. per gallon, for 95-160 quality. Pure benzole and pure toluol are about 3s. to 3s. 3d. per gallon net. Pyridine bases are in little demand; the price being nominal at 7s. 6d. to 8s. per gallon. Sulphate of ammonia remains unchanged.

Tar Products in the Provinces.

May 2.

The average values for gas-works products during the week were: Gas-works coal tar, 50s. to 55s. [Owing to a clerical error, the price of tar was given last week as 59s. to 64s. 2d. The figures should have read 55s. to 60s.]. The tar prices for the week ended April 11 were 58s. 6d. to 63s. 6d.. and for the week ended April 18 the figures were 57s. 6d. to 62s. 6d. Benzole 90 p.ct. North, 2s. 10d. to 3s.; crude

65 p.ct. at 120° C., 2s. 3d. to 2s. 5d. naked at makers' works; 50-90 p.ct. naked, North, 2s. 11d. to 3s. 1d. Toluol, naked, North, 3s. to 3s. 1½d. nominal. Coal tar crude naphtha in bulk, North, 11½d. to 1s. Solvent naphtha, naked, North, 2s. 3d. to 2s. 4d. Heavy naphtha, North, 2s. 9d. to 3s. Creosote, in bulk, North, liquid, 8¼d. to 8¾d.; salty, 8d. to 8¼d. Heavy oils, in bulk, North, 10½d. to 11½d. Carbolic acid, 60 p.ct., 1s. 8d. to 1s. 10d. Naphthalene, £20 to £30; salts, £7 to £9, bags included. Anthracene, "A" quality, 10d. to 1s. per minimum 40 p.ct.; "B" quality, nominal.

FROM A MARKET CORRESPONDENT.

Tar Products.

No improvement is to be noted in these products since the last report. In some cases supplies are scarce owing to the continuation of the coal strike. In most lines, however, there is as much production as is needed at the moment. The price of pitch is about 55s. to 65s. per ton; and those who have pitch to sell do not think these figures very attractive. Buyers, however, appear to have reached the conclusion that pitch prices are hardly likely to fall any lower than they are to-day, and there are, consequently, a few inquiries for the latter part of this year and for next year. The fact that considerable pitch will be used on the roads this year, and that fair quantities of tar will also be required for spraying, is possibly the reason for the view just noted. There is no improvement in solvent naphtha. What little demand there has been for it has been absolutely cut off by the continuation of the strike in the waterproofing trade; and probably 2s. 2d. and 2s. 4d. per gallon would be the nearest value at present. There has been better business in creosote, but not enough to lead to any advance in prices, which remain at 7½d. to 8d. per gallon. There is no export business, though there are some inquiries at prices much less than those quoted. In cresylic acid, there is no alteration; and in carbolic acid, there is no business by which prices can be tested. Nominally crude 60's is 1s. 8d. per gallon, and 39-40 p.ct. crystals 6d. per lb. Benzoles are scarce, though prices remain unchanged. Naphthalenes show little improvement; refined making £18, and crude anything from £6 to £10 per ton. Business in intermediate products continues quiet. Values are well maintained, and one or two lines are inclined to do better. Aniline oil and salt are in better demand at 1s. 8d. and 1s. 10d. per lb. respectively. There is a better tendency in salicylic acid at 1s. 2d. per lb. for technical grade, and 1s. 9d. for B.P. Higher prices are being looked for.

Sulphate of Ammonia.

The production of sulphate of ammonia has naturally fallen off owing to the coal strike; but this is not so important as might appear, in view of the fact that we have arrived at a time of reduced consumption. There is very little to say about the trade, but in all probability it will be necessary considerably to reduce prices of this material to the farmer at the end of the current season. To do this will undoubtedly be a matter of some difficulty, as the cost of production is still maintained at late levels. Wages, of course, may be reduced slightly, and, with the exception of coal, other materials may be a little cheaper, but no large economy seems possible. Nevertheless, in view of the competition of other nitrogenous fertilizers, it would appear as though some reduction will have to be made.

Water-Gas Plant for Gainsborough.—On behalf of the Ministry of Health, Mr. H. E. Byrne lately held an inquiry at Gainsborough regarding an application by the Urban District Council for sanction to borrow £10,838 for the purpose of installing a water-gas plant. There was no opposition; and the Inspector stated that there was no call to discuss the necessity of the new plant, as local authorities up and down the country were remodelling their works, and the Ministry realized the need for this. Mr. J. Baldwin (the Gas Manager) stated that the loss on the gas-works at present stood at over £8000. It was estimated that with the new installation the cost of gas to the consumer could be reduced nearly 50 p.ct.

Penistone Gas Company's Capital.—At a meeting of the Thurlstone Urban District Council, a letter was read from Messrs. Rodgers and Co., solicitors, of Sheffield, stating that the Penistone and District Gas Company were about to make application to the Board of Trade for consent to the issue of £6500 of redeemable or irredeemable preference stock, carrying interest up to 7½ p.ct., in substitution for the £6500 of ordinary stock or shares authorized by the Penistone and District Gas Order, 1913, without offering the same to the public; and for the Board's consent to the Company borrowing on mortgage up to one-half of the paid-up capital for the time being, instead of one-third. After discussion, a deputation was appointed to confer with the Penistone Urban Council on the matter.

Liverpool Gas Fatality.—At the inquest on the bodies of three victims, aged 20, 13, and 5, of a gas-poisoning fatality at Liverpool, a witness said he found that the lead piping connecting the gas-meter with the main was broken, and that the gas was escaping at full pressure. Going upstairs he found all the three victims dead in bed. It had been the practice to put several coppers in the automatic gas-meter before retiring to bed at night, so that there would be a good supply of gas for him in the morning. A witness, representing the Corporation Lighting Department, suggested that what had probably occurred was that, after retiring to bed, the eldest victim remembered that she had omitted to leave a number of coppers in the meter. Somebody had accordingly gone down in the dark, and, in placing the coins in the meter, had put weight on the pipe and fractured it, without being aware of the fact. A verdict of "Death by misadventure" was returned.

No Triple Alliance.

THERE is no Triple Alliance between the gas connection, draw-off cock and flue outlet on Main's "LAUNDRESS" Boiler. Each is entirely independent and can be set at the most convenient angle and the most suitable place irrespective of the position of the others. Easy and economical to fix.

R. & A. MAIN, LTD.

EDMONTON, N. 18, FALKIRK, &c.

Gas-Driven Motor Vehicles.

There was a trial last week at Hampstead of two 3-ton motor lorries driven by gas made in a producer plant carried on the vehicles; the system being that of Producer-Gas Plants, Ltd. From an account of the demonstration given in "The Times," it appears that the producer plant proper, together with the fuel hopper above it, is an oblong steel casing, about 4 ft. high by nearly 2 ft. square. The fire-box, at the bottom of the casing, is lined with a special refractory material, which is said to be able to withstand the heat of an oxy-acetylene flame; and the lower part of the grid that supports the incandescent fuel forms a trough containing water. This arrangement not only prevents overheating of the grid, but also furnishes the steam which is needed for the production of the gas. The water in the trough is supplied from what was previously the petrol tank, and is kept at a definite level by means of a float feed. The rest of the plant consists of a dust box, where the gas is cooled and freed from suspended solids, and of a scrubber, placed at the rear of the vehicle, where it is bubbled through water, and passes up through a grid containing moistened pebbles, to remove any tar and volatile constituents which might interfere with the running of the engine. Thence the gas passes to the throttle. The engine is driven just as on petrol. At starting, a quarter-of-an-hour or so is required to kindle the fire and get the producer into working order. The attraction of producer gas as a fuel for motor vehicles lies in its cheapness; and this consideration has led various inventors to tackle the problem of late years. With the present plant, which was invented by Mr. J. W. Parker and designed by Mr. H.W. Bamber, it is stated that a 3-ton lorry can carry a full load, at the same speed as with petrol, for 100 miles on a consumption of 300 lbs. of coke, costing 10s. 9d., with coke at £4 a ton; whereas the same vehicle, doing the same work, would consume about 17 gallons of petrol, costing £2 11s. With several 3-ton lorries equipped with the plant, which have been running for some time, the fuel costs are given as 1·32d. per mile, or 0·35d. per net ton-mile.

Position of Gas-Meters—Replying to a question by Mr. C. G. Ammon, at last week's meeting of the London County Council, Sir George Piggott (the Chairman of the Public Control Committee) stated that he had no information that a number of houses in south-east London had the gas-meters underneath the floor in the entrance passages. He imagined, however, that it was the practice of companies to fix gas-meters in such a position that they could be secure from accidental damage. With this qualification, companies no doubt arranged for meters to be so placed that they could be easily read for the purpose of preparing customers' accounts. It was not difficult for a consumer to read a meter at the same time that the reading was taken by the company's representative. To a further question by Mr. Ammon as to whether the Council had power to order that meters should be placed so that they could be checked without difficulty, Sir George replied in the negative.

Fine Chemicals and Laboratory Ware.

A memorandum prepared by the Special Purposes Committee of the Institute of Chemistry, on fine chemicals, laboratory glass, and porcelain, has been issued by the Council, who have had these matters under serious consideration. Though before the war the production of chemical reagents in this country was very limited, it is satisfactory to note the statement of the Council that, in spite of all drawbacks, a great advance has been made during the war, and since, by our manufacturers; and this has already enabled professional chemists to obtain practically the whole of the reagent chemicals necessary for their work. Many instances have proved that British manufacturers are capable of producing chemicals in a state of purity fully comparable with that of pre-war supplies from abroad; and the Council emphasize the importance of encouraging home production. They offer assistance to chemists in the obtaining of any materials which they may need. In respect of glass apparatus, certain manufacturers have shown enterprise, ability, and readiness to produce the articles required; but it has become more and more clear that these manufacturers are under the impression that the support which was promised to them during the war, and to which they confidently looked forward, has not been extended to them in a measure sufficient to render them hopeful of the stability of this part of their industry. The Council feel that, if *bond fide* British manufacturers who are prepared to guarantee their productions by their own marks do not receive proper encouragement, the opportunity of establishing firmly the British scientific glassware industry will be lost, and this at a time when, through enterprise and research, success in respect of manufacture and technique has been attained. British-made scientific glassware, equal at least in quality to any hitherto obtainable elsewhere, is, they declare, forthcoming at a price which is not unreasonable in all the circumstances. The Institute have urged users to purchase only laboratory glassware which bears the manufacturers' distinctive marks. The Council also point to the desirability of affording manufacturers of British laboratory porcelain such support as will enable them to complete the final stages of development necessary in order to supply porcelain of at least as high quality as that obtained from abroad.

Hammersmith Public Lighting.—The Hammersmith Borough Council Lighting Committee report that last December the Council agreed to increased charges by the Brentford Gas Company for the lighting and maintenance of public street-lamps, in the case of lamps charged at £5 0s. 9d. to £5 5s. 9d., and those charged at £5 5s. 4d. to £5 10s. 10d. The Company have now communicated their intention to charge for gas to ordinary consumers, as from the 1st ult., at the rate of 1s. 2·6d. per therm, and that therefore the prices charged for street-lamps as from that date will be £5 8s. 8d. per annum for lamps consuming 3·2 c.ft. per hour, and £5 13s. 11d. for those consuming 3·5 c.ft. This increase will entail an addition to the current annual estimates of £104.

SIMMANCE'S DEAD BEAT RECORDER

TAPE CHART PATTERN

For Pressure or Vacuum.

NO LIQUIDS USED.

The chart roll is renewed 6 times a year.

The record can be torn off at any interval.

Lowest Range: 0-2 inches water.

Highest Range: 0-300 lbs. per sq. inch.

Suitable for Gas, Air, Water, or Steam, and may be used on Crude Gas.

MAKERS:

ALEXANDER WRIGHT & Co., Ltd., WESTMINSTER

Brentford Gas Company's Order.

With reference to the report of the Law Committee of the Hammersmith Borough Council which appeared under the above heading on p. 219 of the last issue of the "JOURNAL," it should be pointed out that the statement made by the Committee as to the dividends payable by the Brentford Gas Company under the new conditions is clearly incorrect. The new standard fixed by the Board of Trade is 17·8d. per therm, and not 17·45d. as shown; and the selling price is 14·6d. per therm. The difference being 3·2d., gives sixteen steps of 2s. on the "A" stock and 2s. 6d. on the "B" stock; and provided the dividends can be earned, the Company will be entitled to pay at the rate of £5 12s. p.ct. on the "A" and £5 10s. p.ct. on the "B" stock, or the exact equivalent of the pre-war dividend. The mistake in the Law Committee's calculation is no doubt that they took steps of 1d. per therm instead of one-fifth of a penny per therm, as allowed by the Order.

Waltham and Cheshunt Gas Bill.—The Parliamentary Committee of the Hertfordshire County Council report that a petition against the Waltham and Cheshunt Gas Bill was duly lodged, and negotiations were entered into with the Company to see whether necessary clauses for the protection of the Council could be inserted. The Company agreed to reduce the amount of capital powers by £10,000, and to omit the electricity supply clause. They refused, however, to agree that all piping should in future be laid 3 ft. below the surface of the highway, instead of 2 ft. As it was unlikely that the Committee would grant this, the terms offered by the Company were accepted, and the petition withdrawn.

Gas-Works Conditions at Smethwick.—Quoting in the Town Council figures of gas prices in surrounding towns, Alderman Pinkney said he thought, on the whole, there was not much to complain of at Smethwick, though they intended to do still better. As to the question of retorts, he remarked that, prior to 1911, they had horizontal retorts, and made from 10,000 to 13,000 c.ft. of gas per ton of coal. In that year they introduced vertical retorts; and the amount of gas they made went up to about 22,000 c.ft. per ton. He did not think there was any comparison between the old horizontal retorts and the vertical retorts in cost of working and efficiency, but he pointed out that the comparison was between comparatively new vertical retorts and old horizontal ones. They were now considering further improvements in the retorts, under which it was claimed that, by complete gasification, they could make 60,000 c.ft. per ton; so that, instead of handling 75 tons of coal per million c.ft. of gas, they would only have to handle 17 tons. Gas-making to-day was conducted upon increasingly scientific principles, and research work was revealing wonderful possibilities. Instead of gas being played-out, it was only just being brought out into open daylight; and the future would witness great developments.

Unguarded Gas-Fires.—At an inquest on a child three years of age, who died as the result of burns caused by his nightdress being set on fire through coming in contact with a gas-stove in the bedroom, the Oldham Borough Coroner remarked upon the danger of unguarded gas-fires to persons wearing long dresses. The mother said the fire was lit because she wanted a warm room for the children, and had not had any coal for three weeks.

Lighting of London Schools.—At the last meeting of the London County Council Education Committee, the Elementary Schools Committee reported that they had caused experiments to be made with an improved method of gas lighting at the Berner Street and the Kingwood Road schools. By the use of a new form of superheated inverted incandescent burner, fitted with a special type of shade, it has been found that the lighting is greatly improved. The Committee are advised that, while giving an ample, well-distributed light, the system effects considerable saving in gas consumption and in the renewal of mantles; that the cost of renewing and cleaning globes is eliminated, because globes are no longer required; and that it is not necessary for the burners to be taken off, cleaned, and blown-out monthly, as with the old upright burners. The cost of renewing will also be a negligible item compared with the upright burners. It is estimated that the cost of installation will be covered within a few years by the saving effected in maintenance and gas consumption.

Hong Kong and China Gas Company.—Reporting for the year ended Dec. 31, the Directors of the Company state that the quantity of gas sold at Hong Kong was 12 p.ct. less than in 1919, the business at Kowloon alone showing a slight increase. The lesser sales, with the reduction in price as from Jan. 1, 1920, caused the gas-rentals to be 20 p.ct. less than for the previous twelve months. The falling-off in the business at Hong Kong is disappointing; the price of the gas having been reduced from $2 83 to $2.50, to meet the electric competition. It was not, however, successful; and the Company lost many consumers. There is reason to hope the reduction in the consumption will now cease; and, with the return of prosperity to the Colony, the erection of new houses, and the development of the use of gas for cooking and water heating, the Company may regain the loss in business. The balance of the revenue account has been converted at 4s. 4d. per dollar, as compared with 4s. 1d. in 1919. The Hong Kong balances at Dec. 31 were valued at 3s. 2d. per dollar. The revenue account shows a balance of profit amounting to £2618. Adding to this the balance brought forward from last account, makes a total of £48,685. This, less £2125 for interest on debentures, leaves a net balance of £46,560, out of which the Directors recommend the payment of a dividend at the rate of 5 p.ct. per annum (free of income-tax). This amounts to £3500, and will leave a balance of £43,060 to be carried forward to the next account. The Board feel that the resources of the Company justify a distribution out of the considerable credit to profit and loss account, which has been accumulated for the purpose.

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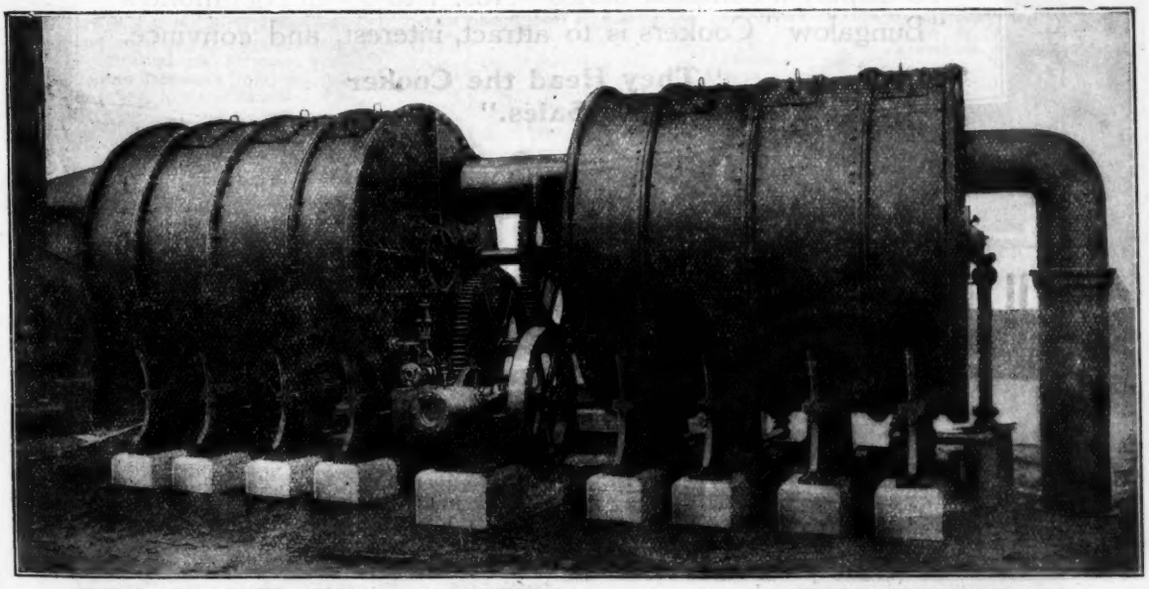

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New Gas Show-Rooms at Burnley.

The new show-rooms of the Burnley Corporation Gas Department were formally opened on the 28th ult., in the presence of a numerous company, including Mr. W. M. Mason (the General Manager of the British Commercial Gas Association), Alderman Waddington (Chairman of the Halifax Gas Committee), Alderman Fell (Chairman of the Nelson Gas Committee), Councillor Hamer (Chairman of the Blackburn Gas Committee), and gas engineers from various local authorities. Alderman Waddington expressed the opinion that there were great possibilities for the future in the steps they had taken that afternoon. Mr. Mason proposed the toast of the "Burnley Gas Department," and said they could have no really direct returns for a venture of this kind; but its value would be shown by the general trend of business. Mr. Mason mentioned figures showing that 2700 trades were regularly using gas; and in these trades there were 370 different processes. Gas should be made so cheap that it would be in universal service, and do two great things—purify the air and assist the ratepayers. Alderman Emmott said that for nearly 38 years Burnley had supplied gas-cookers and gas-fires on reasonable terms, with the result that about 16,000 of these appliances, together with 12,000 breakfast cookers, had been installed. Mr. J. P. Leather (the Gas Engineer) remarked that, while the gas industry was a hundred years old, it was comparatively young, and would show greater advancement. He mentioned that in 1883 the Corporation held a three weeks' advertising gas show; and from that time they had been using gas-cookers, and issuing them up to 700 per year. It was rightly said that the profits of a gas undertaking were made in the retort-house; but it was equally true that these profits could be lost in distribution.

Traders and Lighting Restrictions.—When making an application (which was granted), at the Old Street Police Court, on behalf of the Bethnal Green Coal Officer for a summons under the Coal Emergency Order, 1920, Mr. Margetts said there were certain restrictions, and they had had trouble with a number of tradesmen who would have lights for the purposes of display or advertisement, which was especially prohibited under the Order. Most of the tradesmen, however, had been very reasonable when spoken to.

Housing Schemes and Gas-Cookers.—At a meeting of the Ilford Housing Committee, the Clerk read a letter from the Ilford Gas Company, enclosing a copy of a petition received by the Company from tenants of houses at Tomswood Hill, having reference to the laying of service-pipes to dwellings on the housing sites for the purpose of supplying gas for cooking and heating purposes, and the supply of gas-cookers. The Committee recommend that the Clerk inform the Company in reply that the Council have no objection to the Company, at their own expense, laying service-pipes and making arrangements with the tenants to supply gas-cookers, but that the Council cannot undertake any liability for expenditure in connection therewith.

Unfavourable Results at Londonderry.—At the forty-fifth ordinary general meeting of the Company, the Chairman, moving the adoption of the report, regretted that the result of the past year's working was so unfavourable, and in the opinion of the Directors did not justify the payment of any dividend. They had been passing through exceptional times. Labour had reached a very high rate. Freights were abnormally high, while coal and other materials reached an unprecedented figure. If they were to look for more economical production, they must modernize a certain portion of their plant; and this would require capital. The Directors had had under consideration for some time past a scheme for improving the plant, but until the money market was something near normal they would not feel justified in incurring any large expenditure. All the share capital issued was fully paid-up, and there was no further liability upon the shares. Mr. Henry J. Cooke, who for a number of years past had been Chairman, has resigned his seat on the Board. The vacancy has been filled by the co-option of Mr. T. H. Corbett.

At Oswaldtwistle, the gas-works are dependent upon electricity as the motive power. The manager has therefore allotted 50 tons of coal to the Accrington Electricity Works—realizing that, if the current is cut off, the manufacture of gas will be seriously affected.

We are asked to point out, for the benefit of those in the gas-mantle trade, that Lindsay thorium is always sent out by Messrs. Paul Winn and Co., Ltd., in sealed bottles, and that Messrs. Lindsay's guarantee of 48 p.ct. minimum oxide content does not apply to any thorium which may be packed in Lindsay bottles, unless the bottles bear their labels and seals.

Messrs. A. & W. Richards have received instructions from the Directors to issue £120,000 of 7½ p.ct. redeemable preference stock in the Croydon Gas Company, which, at the price fixed upon of £96, will, allowing for redemption, yield 8 p.ct. The stock is to be redeemed at par on July 1, 1936. Applications should be sent in not later than 11 o'clock on Thursday, May 12.

The funeral took place last Friday of Mr. William E. Bull, who was senior representative of Messrs. Falk, Stadelmann, and Co., Ltd., with whom he had been for the past twenty years. Mr. Bull had spent his life in connection with the illuminating trade; having entered the service of one of the pioneer firms in the oil-lighting industry as long ago as 1874. His ability and genial personality won him many friends.

Mr. Charles Wood, the Bradford Corporation Gas Engineer and General Manager, was a member of a deputation which went from Bradford to London expecting to give evidence before a Select Committee appointed to inquire into the application of the Leeds and Liverpool Canal Company for power to close the Bradford-Shipley section of the canal. The Committee, however, rejected the Bill without calling on the witnesses.

Your Showroom Window.
To display a complete series—Nos. 1 to 5—of Richmond's "Bungalow" Cookers is to attract, interest, and convince.
"They Head the Cooker Sales."

Advertisement of The Richmond Gas Stove & Meter Co., Ltd., Warrington and 164-172, Queen Victoria Street, London, E.C.4.

STOCK MARKET REPORT.

A RATHER better tone characterized business on the Stock Exchange at the reopening last week, and there seemed to be a little more activity—at all events, in the leading markets. This was fairly well maintained for the next two days, and on Thursday was further promoted by the reduction of the Bank rate from 7 to 6½ p.ct., though a greater fall had been expected. On Friday, however, the position was turned for the worse by the breakdown of the coal negotiations, and prices shrank accordingly.

The gilt-edged market was much affected. Home Government issues, on balance of rises and falls, came out irregularly. In the big four, Consols and War Loan lost, and Funding and Victory gained; Friday's figures being: Consols 47⅜ 47$\frac{15}{16}$, War Loan 87$\frac{7}{8}$-88$\frac{8}{16}$, Funding 71$\frac{1}{8}$-71$\frac{5}{8}$, Victory 78$\frac{1}{8}$ 78$\frac{3}{8}$. Bonds and the New Loan were well supported. Home Rails closed weak; but Canadians and Argentines were firmer.

The Foreign Market was not particularly strong, and profits were being secured in some lines; but French, Italian, and Portuguese were in demand.

In the Miscellaneous department, Rubber was dull; but Oils and some of the other Industrials were firm.

Business in the Gas Market was up to a fair pitch in point of volume, and the general tendency was favourable. The London Companies were firm. South Metropolitan rose 1, and Gas Light and Commercial touched higher prices. Suburban and Provincial were steady, and Newcastle rose 2. In Continentals, European had a further advance. Imperial was done at all sorts of prices as "exceptional" bargains; but the quotation was dropped 2 to 148-153, and the bulk of the transactions marked were within these limits.

Bargains done for cash during the week were as follows: On Monday, Commercial 4 p.ct. 51¼, European 7½, 7⅝, Gas Light ordinary 52⅝, 52⅞, 53⅜, ditto preference 57, ditto debenture 49, 49½, 49⅞, Imperial Continental 151, 152, 152½, 153 (and exceptional 156½, 168⅜, 175), Lea Bridge 61, Oriental 86, Primitiva 10s. 6d., ditto preference 27s., South Metropolitan 63⅛, 63½, 63¾, 64, Tottenham debenture 53½, Harrow and Stanmore 5 p.ct. 50¼, 50½, Hornsey 10 p.ct. 95. On Tuesday, Commercial 4 p.ct. 51¼, 51⅜, 52½. Imperial Continental 150, 151, Monte Video 67, Oriental 90½, South Metropolitan 63, 63½, 64, South Suburban 56⅜, 57½. On Wednesday, Alliance and Dublin 42⅛, Bombay 4, Commercial 4 p.ct. 50, ditto debenture 44, Croydon "B" 101, European 7½, Gas Light ordinary 53, 53⅜, 53½, ditto preference 58, Imperial Continental 149, 150, 152 (and exceptional 162½), Oriental 90½, Primitiva preference 26s. 9d., ditto debenture (1911) 38½, River Plate debenture 38½, 39. On Thursday, Commercial 4 p.ct. 50½, Gas Light ordinary 53, 53½, 53⅜, Imperial Continental 149, 150, 150½, 151 (and exceptional 137½), Newcastle 58, Oriental 90, South Metropolitan 63⅜, 64. On Friday, Brentford "A" 53, 53½, 54, British 22⅜, Croydon "A" 123, 124, Continental Union preference 30, Gas Light ordinary 53½, Imperial Continental 148½, 150, 151 (and exceptional 137½, 143⅜, 148, 156½) South Metropolitan 64⅛, 64½.

In the Money Market, the all-engrossing incident was the long-desired reduction in the Bank rate. But seldom if ever before had so high a rate had so small a reduction; and this caused disappointment. Another unprecedented feature was the fact that so high a rate as 7 p.ct. had lasted for a year and seven days. However, the measure of relief, though not full, was welcome.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
182,049	Stk.	Mar. 11	4	4%	Aldershot 4 p.c. Pref.	...	53—58	
1,551,868	,,	Apl. 14	2½	3⅛%	Alliance & Dublin Ord.	59—64	39—44	42½
374,000	,,	Jan. 13	4	4%	Do. 4 p.c. Deb.	76—79	47—52	...
280,000	5	Oct. 28	7½	8%	Bombay, Ltd.	5⅜—6⅛	4—4½	4
100,000	5	Feb. 25	16	5%		...	7—8	...
383,110	10	,,	7	7%	Bournemouth Gas and Water { 5 p.c. B 7 p.c. Pref. 6 p.c. 4 p.c. Deb.	15—15½	8½—9½	...
115,000	10	,,	6	6/-		13½—14	7⅛—8½	...
162,065	—	Dec. 30	—	4%		...	55—60	...
992,045	Stk.	Feb. 25	14	30/-	Brentford A Consolid.	261—266	50—55	53—54
734,920	,,	,,	11	26/3	Do. B New	204—209	47—52	...
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	68—73	...
221,400	,,	Dec. 15	4	4%	Do. 4 p.c. Deb.	91—93	57—59	...
214,775	,,	Mar. 11	11	7½%	Brighton & Hove Orig.	208—213	95—105	...
244,200	,,	,,	8	5⅓%	Do. A Ord. Stk.	154—159	65—75	...
1,287,500	Stk.	July 29	5	5%	Bristol 5 p.c. max.	...	...	...
530,000	20	Mar. 30	12½	10%	British	44—45	21—23	22½
120,000	Stk.	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	88—90	50—55	...
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	37—40	...
100,000	10	May 27	—	—	Cape Town & Dis., Ltd.	1½—2½	7—7½	...
100,000	10	Apl. 28	—	4½%	Do. 4½ p.c. Pref.	4—6	4½—5½*	...
100,000	Stk.	Dec. 30	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	55—60	...
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	...	...
1,513,280	,,	Feb. 25	5/9/4	30/-	Commercial 4 p.c. Stk.	106—108	48—53	50—52½
560,000	,,	,,	5⅓	26/3	Do. 3½ p.c. do.	103—105	45—50	...
475,000	,,	Dec. 15	3	3%	Do. 5 p.c. Deb. Stk.	69½—71½	42—45	44
800,000	,,	Dec. 11	4	—	Continental Union Ltd.	76—79	20—25	...
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	30—40	30
51,600	,,	Feb. 5	15	10%	Croydon A 10 p.c.	...	120—130	123—124
278,400	—	,,	12	7%	Croydon B and C 7 p.c.	..	95—105	101
492,270	Stk.	—	6	4½%	Derby Con. Stk.	123—125	...	..
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	...	...
1,002,180	10	Jan. 29	10	5/0	European, Ltd.	17½—18	6½—7½	7½—7⅝
16,298,975	Stk.	Feb. 10	4/17/4	30/-	Gas Light and Coke { 4 p.c. Ord. 3½ p.c. max. 4 p.c. Con. Pref. 3 p.c. Con. Deb. 10 p.c. Bonds.	98—102	51—54	52½—53⅛
2,600,000	,,	,,	3⅛	26/3		76—79	41—44	...
4,062,235	,,	,,	4	4%		96—99	56—59	57—58
4,674,850	,,	Dec. 15	3	3%		72½—74½	47—50	49—49⅞
130,000	,,	Dec. 11	10	10%		...	...	...
82,500	,,	Mar. 11	5	3⅛%	Hastings & St. L. 5 p.c.	...	48—53	...
258,740	,,	,,	3½	2½%	Do. 3½ p.c.	87—89	34—39	...
70,000	10	May 13	11	8%	Hongkong & China, Ltd.	16½—16¾	8¼—9⅛	...
86,600	Stk.	Mar. 11	9	5⅝%	Hornsey 7 p.c.	...	75—85	...
131,000	,,	Mar. 30	7½	3⅛%	Ilford A and C	151—154	75—79	...
65,780	,,	,,	6½	2½%	Do. B	115—118	55—60	...
65,500	,,	Dec. 30	4	4%	Do. 4 p.c. Deb.	92—94	54—56	...
1,976,000	,,	,,	9	5%†	Imperial Continental	150—160	148—153	149—153
1,235,000	,,	Feb. 10	3½	3⅛%	Do. 3½ p.c. Deb. Red.	84—86	75—80	77½
235,242	,,	Mar. 30	6½	3⅛%	Lea Bridge Ord. 5 p.c.	119—121	58—63	61
2,498,905	,,	Feb. 26	10	37/6	Liverpool 5 p.c. Ord. { A. B.	211—213	...	...
						146—148	...	...
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	...	...	...
165,736	,,	Feb. 25	7/5/6	3⅛%	Maidstone 5 p.c.	...	52—57	...
75,000	5	June 11	6	3%	Malta & Mediterranean	4⅛—4½	1⅞—2½	...
250,000	100	Apl. 1	4½	4⅛%	Met. of Melbourne { 4½ p.c. Deb.	99—101	88—93	...
541,920	Stk.	Nov. 26	4	6%	Monte Video, Ltd.	11¼—12	60—70	67
1,875,892	,,	Feb. 25	4½	3⅛%	Newcastle & Gatsh'dCon.	98½—99½	57—59	58
529,705	,,	Dec. 30	3½	3⅛%	Do. 3½ p.c. Deb.	82—83	50—51	...
15,000	10	Mar. 11	—	8%	North Middlesex 10 p.c.	...	12½—13	..
55,940	10	,,	7/14/0	5⅝%	,, ,, 7 p.c.	14—15	7—7½	...
300,000	Stk.	Nov. 26	8	8%	Oriental, Ltd.	117—122	87—92	86—90½
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	2—3	...
60,000	50	Feb. 25	13	7½%	Portsea Island, B	128—131	65—70	...
100,000	50	,,	12	6¼%	Do. C	118—121	50—55	...
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	⅛—⅛	10/6
499,960	5	June 26	5	—	Do. 5 p.c. Pref.	4⅛—5	1¼—1½	26/9—27/-
521,600	100	Dec. 1	4	4%	Do. 4 p.c. Deb.	91—93	67—69	
600,000	Stk.	Jan. 27	4	4%	Do. ,, ,, 1911	...	37—40	38½
346,198	,,	Dec. 30	4	4%	River Plate 4 p.c. Deb.	85—87	37—40	38½—39
150,000	10	Mar. 30	6	6/-	San Paulo { 6 p.c. Pref. 5 p.c. Deb.	10½—11	6—7	..
125,000	50	Jan. 3	5	5%		47—49	37—39	...
135,000	Stk.	Mar. 30	10	5%	Sheffield A	223—224	62—64	...
209,984	,,	,,	10	4½%	Do. B	222—224	62—64	...
523,500	,,	,,	10	3⅛%	Do. C	220—222	60—62	...
133,201	Stk.	Sept. 15	4	4%	Shrewsbury 5 p.c.	...	...	...
90,000	10	Sept. 30	9	9%	South African	10½—11½	10½—11½	...
6,609,895	Stk.	Feb. 10	5/4/0	5%	South Met. Ord.	111—113	63—66	63—64½
250,000	,,	Jan. 13	—	5%	Do. Red. Pref.	...	90—92	...
1,895,445	,,	,,	3	3%	Do. 3 p.c. Deb.	72½—74½	45—48	...
224,820	,,	Feb. 25	8½	7½%	South Shields Con. Stk.	157—159	86—88	...
1,087,795	,,	,,	6	3⅛%	S'th Suburb'n Ord. 5 p.c.	114—116	56—61	56½—57½
247,558	,,	Dec. 30	5	5%	Do. 5 p.c. Deb. Stk.	116—118	65—70	...
647,740	,,	Nov. 12	7½	3⅛%	Southampton Ord.	99—102	55—58	...
121,275	,,	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	...	57—59	...
120,000	,,	Feb. 25	—	3⅛%	Tottenham District { A 5 p.c. B 3½ p.c. 4 p.c. Deb.	135—138	57—62	...
782,275	,,	,,	6	2⅛%		115—117	50—55	...
181,255	,,	Dec. 15	4	4%		87—89	53—56	53½
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	...
149,900	10	July 1	5	3%	Do. 5 p.c. Deb. Red.	93—95	45—50	...
236,476	Stk.	Feb. 25	5	3⅛%	Tynemouth 5 p.c. max.	108½—109	68—70	...
					Wandsworth, Wimbledon, and Epsom—			
30,000	,,	Feb. 25	8⅛	47/6	Wandsworth A 5 p.c.	151—156	75—80	...
255,636	,,	,,	6½	32/6	Do. B 3½ p.c.	129—134	53—58	...
108,075	,,	,,	—	33/3	Do. C	...	50—55	...
140,865	,,	,,	—	33/3	New Ordinary	...	50—55	...
352,000	,,	,,	6½	26/3	Wimbledon 5 p.c.	117—122	43—48	...
98,000	,,	,,	6½	32/6	Epsom 5 p.c.	121—126	50—55	...
88,416	,,	Dec. 30	3	3%	3 p.c. Deb. Stk.	66—69	40—45	...

* Ex Div. † Next dividend will be at this rate.

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Samuel Parker,
Town Clerk.

Town Hall,
Bolton,
April 30, 1921.

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